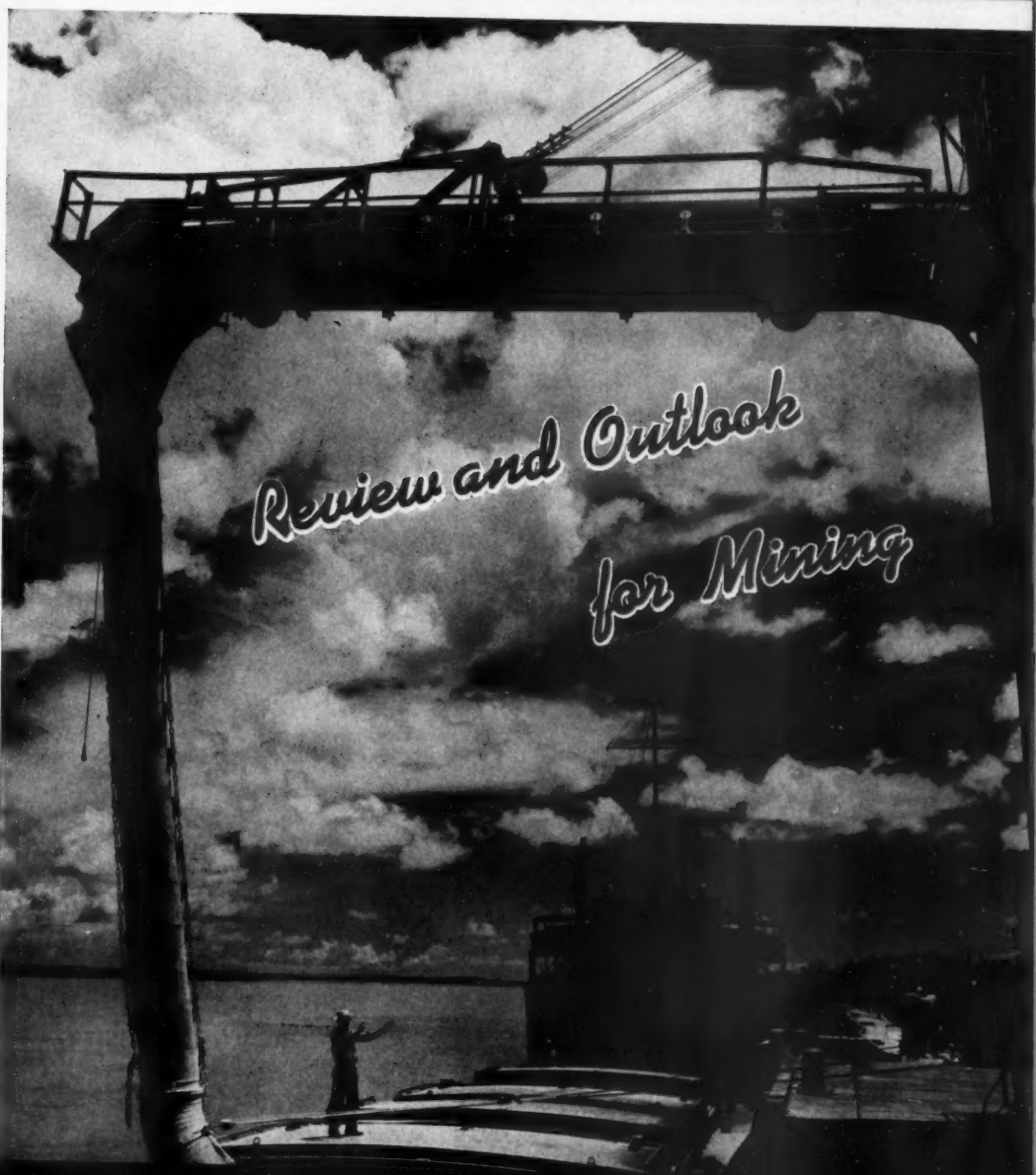
MINING CONGRESS JOURNAL



TALKING DISTANCE...OVER 5 MILES...
Laytex Assault Wire assures clear, sure transmission of messages—a prime military requirement for battlefront communications. An invaluable property when advance scouts have been cut off from their company and virtually surrounded in enemy territory.

LAYTEX ASSAULT WIRE IS LIGHTWEIGHT
...and fully dependable. One man carries enough wire to keep communications open—travels fast and far without being hampered by excess, needless weight.

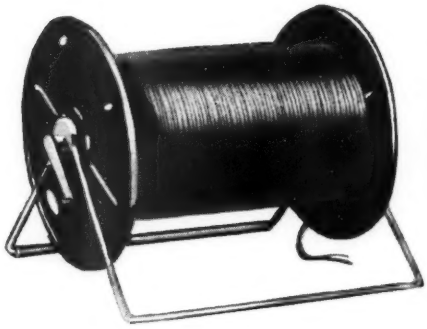
JUNGLE DAMP'S A KILLER

The jungle's a dirty fighter. Vines and underbrush seem to grow across your way while you watch them. The sun doesn't get through...and it's damp. The heavy, hot kind of damp that means mildew and decay to every piece of equipment not specially made or treated to resist them.

Laytex Assault Wire is specially made to resist damp. The high quality, uniform insulation is entirely free from water-soluble elements. It is unaffected by prolonged exposure to moisture, provides maximum protection to the accurately centered conductors.

Not only that...the special Laytex Insulation has high resistance to concussion and does not become embrittled when wire is subjected to repeated vibration and shock. It readily withstands temperature changes. Its uniformly high quality permits the thickness of the insulation to be kept at the minimum. As a result, Laytex Assault Wire is extremely lightweight. A mile weighs less than 30 pounds. Laytex Assault Wire has a talking distance of better than 5 miles, and was developed for front line service by United States Rubber Company scientists working in close cooperation with engineers of the Army Signal Corps.

These same properties—light weight, small diameter, ability to withstand temperature changes, flexibility and toughness make other types of Laytex Wires and Cables as important in peacetime industry and building as they are to the Armed Forces.



Laytex

ASSAULT WIRE

SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

1230 Sixth Avenue, Rockefeller Center, New York 20, New York

MINING CONGRESS JOURNAL

VOLUME 30, NUMBER 2 FOR FEBRUARY 1944

Contents

★

THE AMERICAN MINING CONGRESS

309 MUNSEY BLDG., WASHINGTON 4, D. C.

HOWARD I. YOUNG, *President* — DONALD A. CALLAHAN, *Vice President* — LOUIS S. CATES, *Vice President* — JAMES D. FRANCIS, *Vice President* — JULIAN D. CONOVER, *Secretary*

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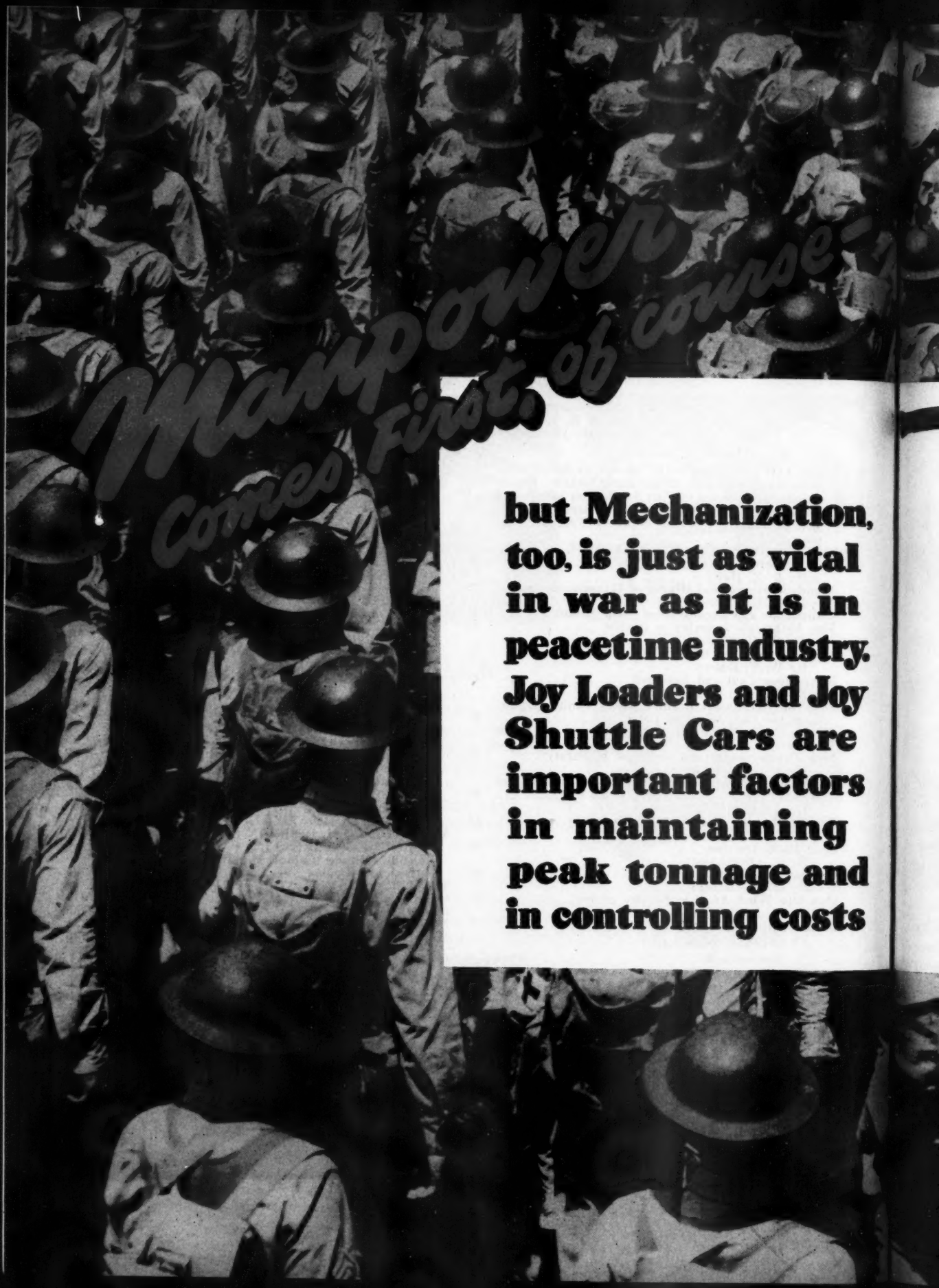
Member, Audit Bureau of Circulations.

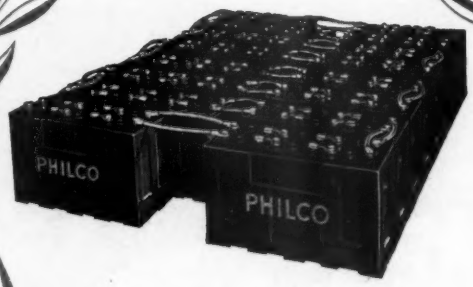


but Mechanization, too, is just as vital in war as it is in peacetime industry. Joy Loaders and Joy Shuttle Cars are important factors in maintaining peak tonnage and in controlling costs


JOY Loaders
JOY 8-BU LOADER
A sturdy, lightweight machine for comparatively low seams — 36" high — 1½ tons per minute.
JOY Shuttle Cars
JOY 32-D SHUTTLE CAR
(Permissible Type)
3½ ton capacity for low seam operation.
A JOY ENGINEER IS ALWAYS AVAILABLE FOR CONSULTATION
JOY MANUFACTURING CO.
FRANKLIN, PA.

PHILCO *Mine Batteries*

FOR MORE COAL ON EVERY SHIFT!



TYPICAL PHILCO MINE LOCOMOTIVE BATTERY
MADE UP OF TYPE 25 AMA MONOBLOC UNITS

With rugged, heavy-duty Philco Batteries in your mine locomotives you get the extra wallop you need to move out loaded cars *quicker* and have empties back *faster!* Furthermore, you get this extra wallop *hour after hour* because every Philco mine battery is engineered to deliver *sustained* high voltage! The Philco grid itself is designed to provide high electrical efficiency and superior conductivity. The Philco "K" Process of dehydration permits the use of flake oxide as active material, producing a plate of exceptional hardness, porosity and high capacity. These are important battery features that you get *only in a Philco!* For complete information, write for the Philco Mine Battery Catalog.

Philco Corporation, Storage Battery Division, Trenton 7, N. J.

REPLACE WITH RUGGED PHILCO BATTERIES

ARMY E NAVY

Only SULLIVAN DRIFTERS
can have the DUAL VALVE • •

...Only the Dual Valve can give you the power of stroke that means maximum footage

No one can deny the footage a drill drives depends on the number of blows struck and the power behind each blow. So when one drifter consistently outperforms another on the same compressor, in the same rock, you know there *must* be a difference between drills. What is it?

The Dual Valve, a patented, exclusive Sullivan feature, operates as follows: The correct air volume for maximum striking power is admitted behind the piston; then the valve closes and the piston is propelled by air expansion; AFTER the piston delivers its full force of blow to the steel, the reverse valve opens and delivers the correct amount of air ahead of the piston to give a return stroke with strong rotating power.

This sounds obvious. But the difference is tremendous. With no compressed air ahead of the piston on the forward stroke, there is none to block the hammer blow on the drill steel. The gauge reading of 15% air economy merely says *the air you have strikes a 15% harder blow.* These and other facts explain why Sullivan T-350 Drifters last so long and perform so well. SULLIVAN MACHINERY COMPANY, Michigan City, Indiana. *In Canada:* Canadian Sullivan Machinery Company, Ltd., Dundas, Ontario.

30% More Bearing Surface on the Exclusive Locking Chuck

Another of the sound Sullivan engineering features, the locking chuck combines lock ring and chuck bushing in one part, supports the drill steel *at and beyond* the lug. With 30% greater bearing area, the drill steel and the locking chuck *must last longer.* It holds drill steel in line better, keeps it from kicking out of chuck. It can be renewed inexpensively and easily. Such Sullivan features assure as much as 62% lower maintenance and other advantages which are steadily winning new friends for this old company that has pioneered the way for 93 years.

Other T-350 Features

Convenient release stops rotation to spot hole.

Reversible pawls give double life.

Throttle has off, spotting, drilling and blowing positions.

Large oil reservoir can be filled whether drilling horizontally or vertically.

Low center of gravity makes the T-350 easy to handle.

Piston-motor feed runs steel down automatically. Smooth, vibration-free pressure that lengthens drill life. Safe retraction at full speed. Multi-position throttle allows most efficient speed for all drilling conditions.

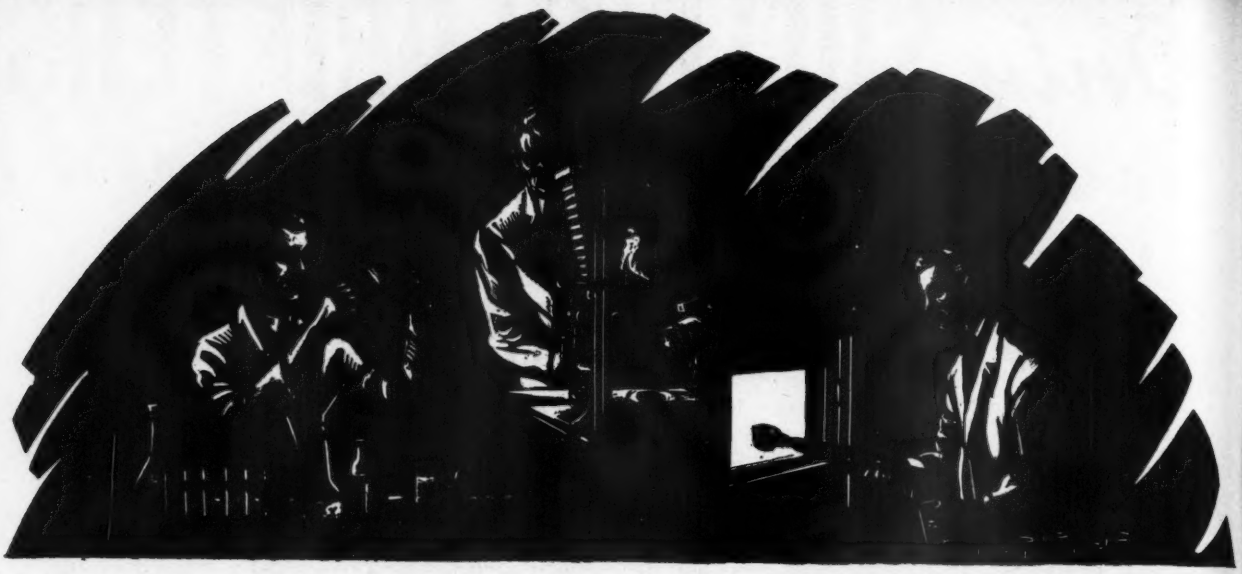
Sullivan PRODUCTS

ROCK DRILLS • AIR COMPRESSORS
SCRAPER HAULERS • HOISTS • CORE
DRILLS • LOADERS • CONTRACT
CORE DRILLING

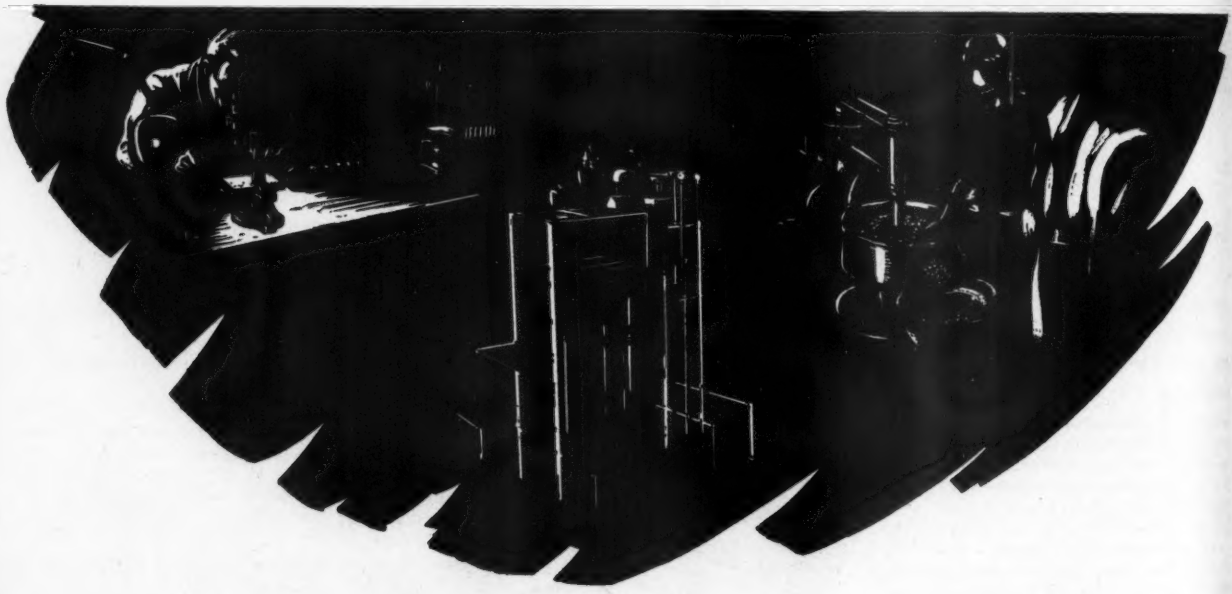
Sullivan BRANCH OFFICES

BIRMINGHAM, BOSTON, BUTTE, CHICAGO, DALLAS, DENVER, DULUTH, EL PASO, HUNTINGTON, KNOXVILLE, NEW YORK, PITTSBURGH, ST. LOUIS, SALT LAKE CITY, SAN FRANCISCO, SCRANTON
and in Principal Cities Throughout the World

SULLIVAN
ROCK DRILLS FOR FOOTAGE AND ECONOMY



MEMO TO POST WAR PLANNERS ABOUT C



For the past two years Cyanamid, like yourself, has been intensively engaged in rush work directly related to wartime expansion of metals output. With metal production secure for this war, the Cyanamid Ore Dressing Laboratory and Cyanamid Field Engineers will soon have time for longer-range study of your post-war milling problems.

AMERICAN CYANAMID COMPANY

Accelerated depletion of proven ore-bodies, opening of new ore-bodies under wartime price-levels, obsolescence of pre-war milling equipment, advances in beneficiation techniques and mill equipment, possibilities of pre-concentrating low-grade deposits, and the probability of sharply competitive post-war metal prices all combine to warrant critical re-examination of every step in your present recovery method. Constructive study and testing *now* may very well make the difference between fair profits, marginal operation or shut-down for many mills tomorrow.

CYANAMID SERVICE TO METALLURGY

In this realistic re-appraisal of your concentration processes Cyanamid offers its composite experience in Heavy-Media Separation, Flotation, Cyanidation and all combinations of these processes. Cyanamid offers also the facilities and personnel of the Cyanamid Ore Dressing Laboratory with its Chemical, Physical and Microscopical Departments for the examination of your ore and development of a low-cost flow scheme.

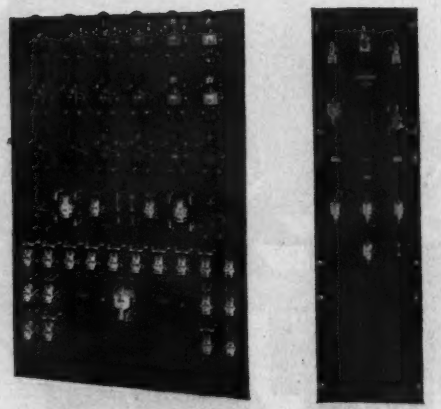
And in the practical application of test results, Cyanamid Field Engineers stand ready to work with you in your mill, and to recommend from Cyanamid's complete line the reagent combination for the highest recovery at the lowest cost.

We welcome correspondence from interested metallurgists.

30 ROCKEFELLER PLAZA • NEW YORK 20, N. Y.

Thousands of

This 20-cu-yd shovel, having exceptionally long reach and high lift, is making a remarkable record for tonnage handled. Amplidyne control permits the operator to make fast getaways, without straining the equipment.



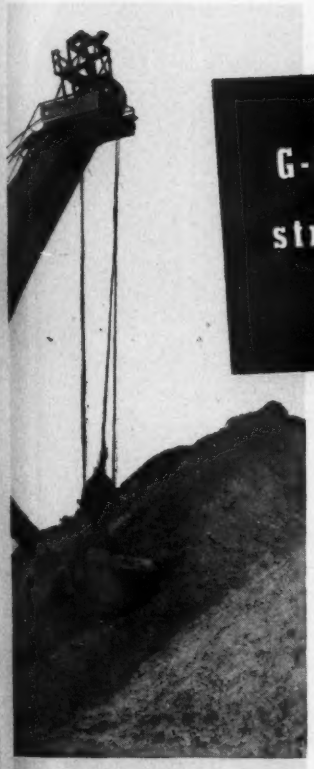
CONTRAST IN CONTROL

(Left) Conventional mine-hoist control panel. (Right) Control for similar hoist with new amplidyne system. Graphically, this shows how amplidynes assume the duties of field-current contactors, associated relays, and the many current-carrying contacts.

The amplidyne is truly a versatile control tool. Responding instantly to electric signals in the order of 3 watts, it furnishes a controlled flow of large amounts of power, amplifying the signal as much as 10,000 to 1.

EXTRA YARDS per month

G-E amplidyne control helps world's biggest stripping shovels meet today's unprecedented demands for bituminous output



This 35-cu-yd electric stripping shovel is equipped with G-E amplidynes for control of hoist, swing, and crowd motions. Amplidynes provide extra power during motoring, yet minimize overshooting and load peaks during plugging and stalling.

Capable of swinging 60-ton loads at the end of a 60-ft dipper stick, these are the largest-capacity shovels in the world. Yet in spite of their great size, operation is smooth, accurate, and fast.

How do G-E amplidynes provide such control? How do they help one of these giants scoop away overburden at better than 35 cubic yards a minute? Amplidynes perform a four-fold service:

First, they provide faster acceleration and deceleration for the hoist, swing, and crowd motions.

Second, by their forcing action, amplidynes provide higher average cycle speeds.

Third, they assure smooth, uniform application of motor power at all speeds.

Fourth, they act as safety valves, limiting the motor torque to protect electrical and mechanical equipment during stalling or fast reversals.

Shovel control is but one example of where amplidynes are speeding "more coal for Victory." Mine-hoist control is another. Still a third is the quite different application of amplidynes to power-factor regulation. Here, amplidynes are serving to increase the capacity of long power lines to open-pit operations, by improving voltage conditions.

For experienced engineering assistance on any phase of mine electrification—amplidynes, mining locomotives, switchgear, transformers, motors, or controls—get in touch with our local office. *General Electric Company, Schenectady, N. Y.*

FREE *thirty-six page book telling and showing how the amplidyne works, and detailing many of its present applications—including electric shovels. Ask for our bulletin, GEA-4053.*

GENERAL ELECTRIC

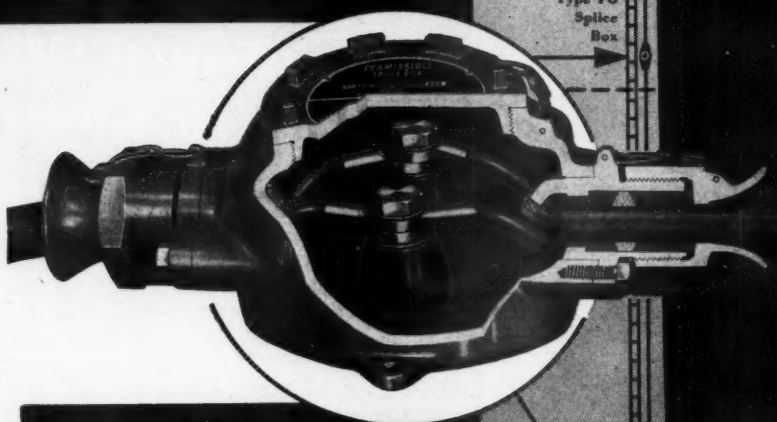
AMPLIDYNES

The best investment in the world is in this country's future—
BUY WAR BONDS

HOW TO CONSERVE

Rubber-Covered Trailing Cables?

THE ANSWER IS SECTIONALIZATION--



--the O-B Type FG Gas-Proof Splice Box provides the Means

HOW SECTIONALIZATION WORKS

Instead of using one trailing cable, the length of a finished room, sectionalize your cable into several shorter lengths. Start working with just one section (step A). As your room progresses beyond its limits, bolt on another section (step B), repeating the process until the full length of the room is reached (step C). You'll save cable in these important ways:

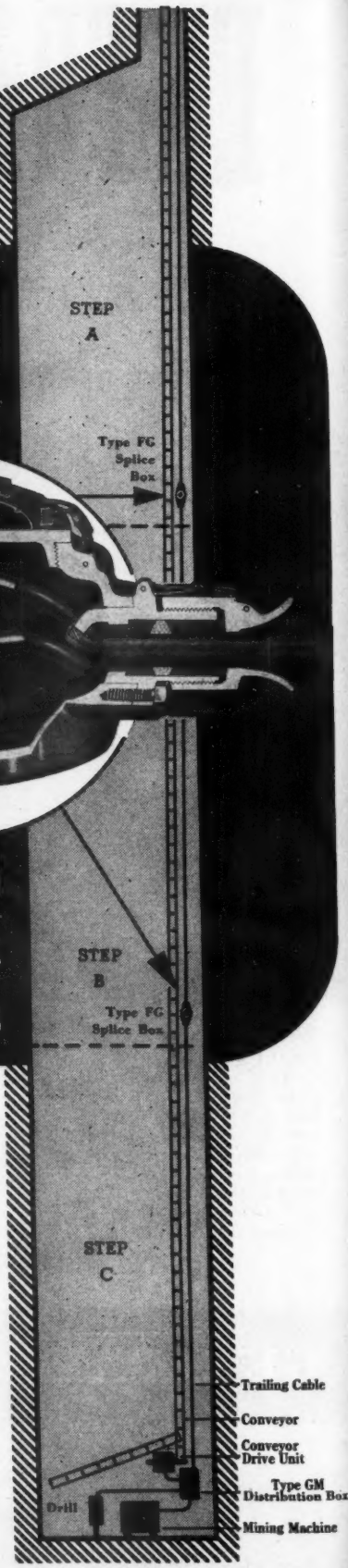
No excess cable in service vulnerable to mechanical damage ● Amount of cable energized and subject to heat deterioration kept at minimum ● Cable sections may be shifted from room to room as needed ● Defective sections easily removed for repair with minimum shutdown.

Write for Booklet

778M

Glands assembled and sealed on cable ends...No need to repack in making or changing connections ● Approved by U.S. Bureau of Mines for use in gaseous areas ● Only four bolts to tighten for positive, gas-tight splice ● Permanent, boltless safety ground connection.

2433-M

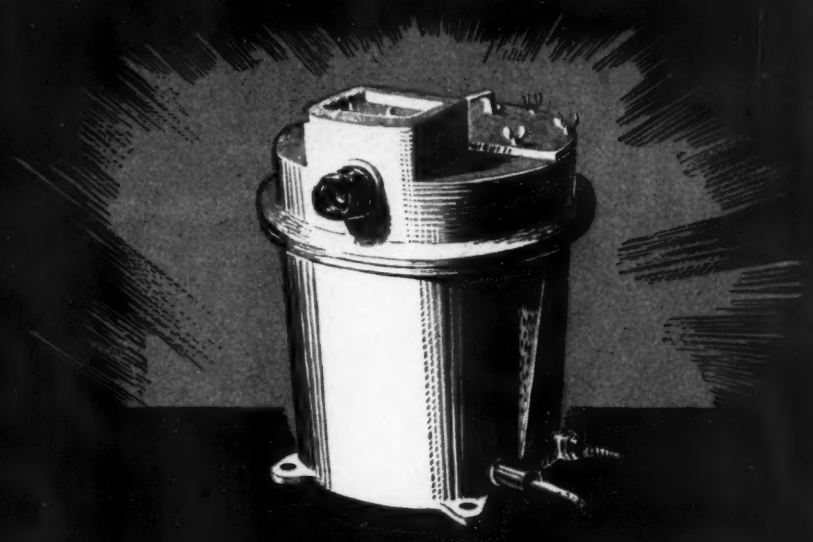


Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

WORLD'S FASTEST CAMERA
Charts a Burst of Dynamite



TO CAPTURE pictures of explosives *in action,* Hercules scientists designed and built the world's fastest camera. Operating at exposures as fast as *one ten-millionth of a second,* this amazing instrument photographs dynamite at the very instant of its violent chemical change. Even powerful nitroglycerin's path of detonation, traveling at 250 miles a minute, is "stopped" on film by this shutterless, electrically operated camera.

This study of how explosives behave is only a small part of the intensive research being conducted daily by Hercules. Physicists, x-ray workers, microscopists, and other highly trained specialists are constantly searching for new and valuable knowledge on explosives which may prove helpful to you and your business.

---------- *HERCULES EXPLOSIVES* -----

HERCULES POWDER COMPANY
INCORPORATED
934 King Street

XR-40

Wilmington 99 . . . . . Delaware

No other industry rivals metal mining in the essentiality of its products for warfare, nor can any other industry make its full contribution to victory without these products. All the implements and instruments of modern warfare call for metals in ever increasing quantities—and our mines today are setting new production records.

Increased output means added wear and tear on machinery, more repair parts, new equipment—the responsibility of the equipment manufacturer is no less than that of the mine operator in the constant drive to produce more metals.

Today, more than ever before, it is essential that the supplier and operator work together. Only by careful study of each other's problems, by coordinated planning, by a united effort can the common objective be achieved. Contact our engineering service division nearest you. They will gladly help you with your problems.

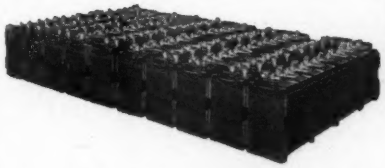
Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

5-366

COMPRESSORS • TURBO BLOWERS • ROCK DRILLS • AIR TOOLS • OIL AND GAS ENGINES • CONDENSERS • CENTRIFUGAL PUMPS

THESE STORAGE BATTERIES ARE VETERANS OF TWO WARS



A Report on Conservation for Users of Mine Locomotives and Shuttle Cars

ADVANTAGES OF THE EDISON ALKALINE BATTERY IN MINE LOCOMOTIVES AND SHUTTLE CARS

★ It is durable mechanically. High strength steel construction is used in the containers, grids, pole pieces, etc. The electrolyte is a preservative of steel.

★ It is foolproof electrically. It may be accidentally short-circuited, over-charged, over-discharged, or even charged in the reverse direction without injury.

★ It can be charged rapidly. It does not require critical adjustment of charge rates and, therefore, can be charged directly from the d-c mine power supply. It has no finish-rate limitations. It requires no equalizing.

★ It withstands temperature extremes. It is not damaged by freezing. Free air spaces on all sides of all cells provide ventilation for rapid cooling under high temperature conditions.

★ It is simple to maintain. Merely charge adequately, add pure water, keep clean and dry.

★ Its tray assembly and cell connections are extremely simple.

★ Its life is so long that its annual depreciation cost is lower than that of any other type of storage battery.

During World War I, a New England plant installed a fleet of battery industrial trucks each provided with two Edison Alkaline Batteries, one to operate the truck while the other was on charge. The trucks worked around the clock on war production, but after the Armistice the plant went to an 8-hour day so that one battery per truck was enough and the spare batteries were not needed. They were put into storage and there most of them remained until the outbreak of the present war.

Now they are again in service. In spite of the fact that most of them stood idle for nearly a quarter of a century, they are doing a completely satisfactory job keeping the trucks supplied with power. In fact, shortly after the outbreak of the present war, the plant purchased a new truck without a battery because its reserve stock of spare batteries was still ample.

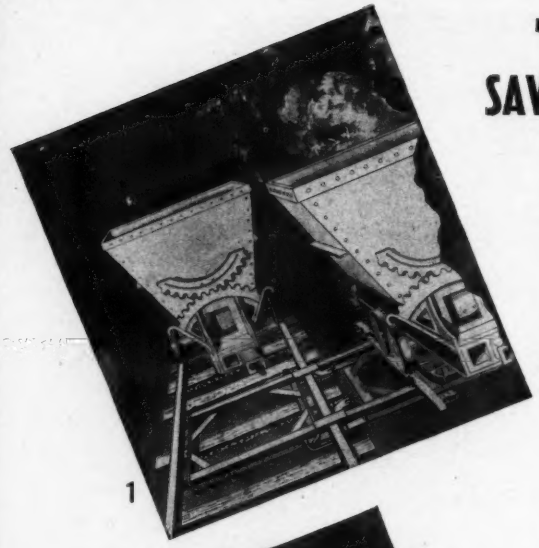
The current performance of these veterans of two wars is living testimony to the extra reserve dependability in the Edison Alkaline Battery. Some of the unique characteristics which account for this dependability are cited in the column at the left.

EDISON STORAGE BATTERY DIVISION, THOMAS A. EDISON, INCORPORATED, WEST ORANGE, NEW JERSEY

Edison

ALKALINE BATTERIES

"CANTON" CAR TRANSFERS SAVE MONEY BY CONTINUOUS LOADING



1

Illustration No. 1—The Narrow Gauge Model is ideal for hard rock mining or tunnel driving. Note that the opening inside wall need be very shallow in order to let cars pass. First cost quickly disappears when Canton Car Transfer simplifies loading process with minimum switching.

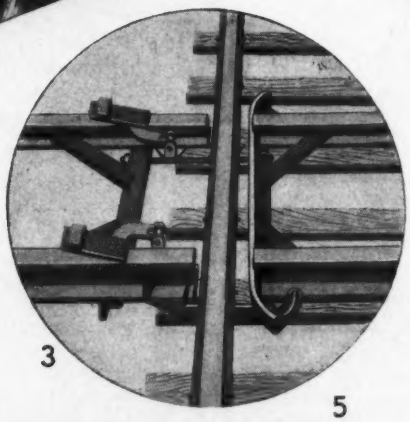
Illustration No. 2—All sections of Heavy Model are built of heavy structural shapes, cross braced and reinforced by welded joints. Will hold large cars up to six tons in weight. Canton Car Transfers are most economical by-passers, can be lifted and placed elsewhere in five minutes by two men.

2

Illustration No. 3—Circle shows close-up view of open track for normal traffic. When shifting cars, sections are flipped down over track rails to permit car transfer to move from right to left, or vice versa.

Illustrations No. 4 and 5—Show Narrow Gauge Model and Standard Gauge Model and how simply they can be installed on any track. Track sections interlock to make rigid installation. Wheels are of manganese steel, Timken roller bearing equipped. The construction is soundly engineered for long wear and all parts are of finest material for the purpose.

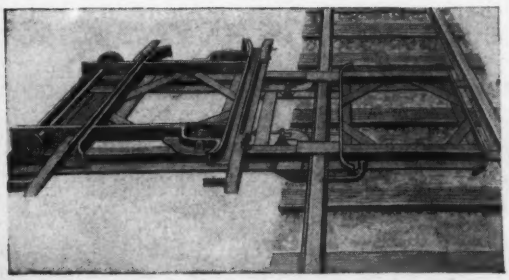
The Canton Mine Car Transfer is sound economy, will pay for itself quickly by reducing number of switching trips, speeding up loading process. It is THE inexpensive apparatus for by-passing cars on single track when working in tunnels or a dead end. It increases mine output with minimum man-power. Write for complete descriptive folder.



3

THE
AMERICAN
MINE DOOR
COMPANY
2063 DUEBER AVENUE
CANTON 6, OHIO

4



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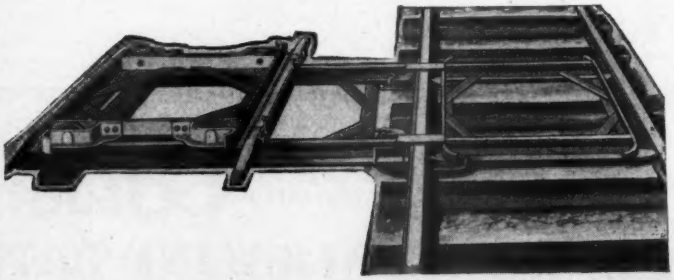
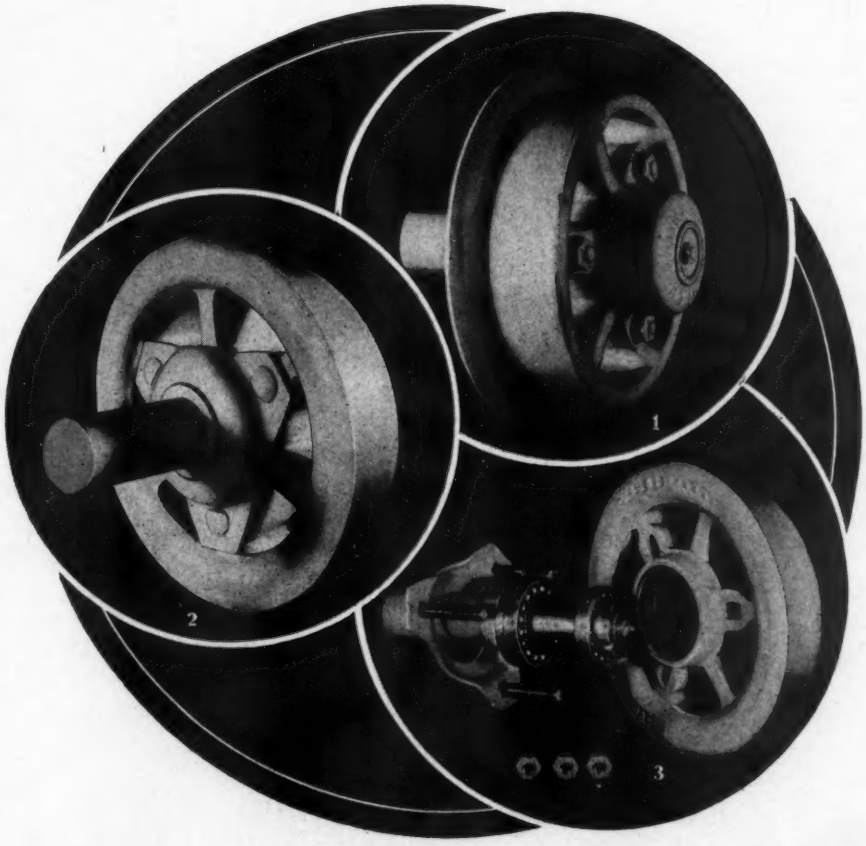


EVENTUALLY—

—you'll use this wheel!



★ **The S-D "Floater" Ball Bearing Wheel, unquestionably, is the mining industry's most perfect, simplest, easiest running, and most economical wheel. We sincerely believe that you will use this wheel once you know its advantages. Our past experience has proved the real worth of "Floaters" to you. Proof records of service have made it possible for us to give you a written guarantee against breakage of wheel castings or failure of bearings for five years. And, if you have to grease "Floaters" more than once in five years, we pay the extra costs. Where else can you get such wheel protection?**

The illustrations on this page show the simple, demountable feature of "Floaters." In photo No. 1 you see the three nuts which hold wheel in place. Remove these—that's all—and your wheel slips off, just like an auto wheel. Shown also is the closed front hub and grease connection—no grease leakage here! Photo No. 2 shows the rear hub cap drawn tight with the three bolts and nuts. Photo No. 3 shows how the bearings remain in place on axle in perfect adjustment when wheel is taken off. No further adjustment is required when wheel is replaced.

Tests made by strictly independent engineering firms have proved that the net loads handled by locomotives can be increased tremendously when cars equipped with wheels having any other type of bearings are changed to S-D "Floater" wheels. The power saving is a big item.

Write to us for the complete story on how you can increase production at great savings with "Floaters." Get our Free Trial Offer.

Sanford-Day Iron Works, KNOXVILLE, TENNESSEE

They practice what they preach

Here in the oil fields, operators talk and produce in terms of thousands of barrels. But when it comes to consumption of these vital stores of petroleum—then these same men are just like any "A" book holder down to his last coupon.

This vigilance against waste is not just a war expediency. It began long before the hooked cross spread its tentacles over the world . . . and its beginning was marked by the introduction of Cummins Diesel Power in the oil fields because it was found to be "Faster and Cheaper than Steam."

Today, in every major producing area, Cummins Dependable Diesels are in the forefront of the petroleum industry's fight to achieve maximum production with maximum economy . . . not only economy in the consumption of fuels and lubricants, but also economy of time, materials and manpower.

Here, truly, is a demonstration of conservation . . . here is an example of men in industry who *practice what they preach!*
CUMMINS ENGINE COMPANY, Columbus, Indiana.

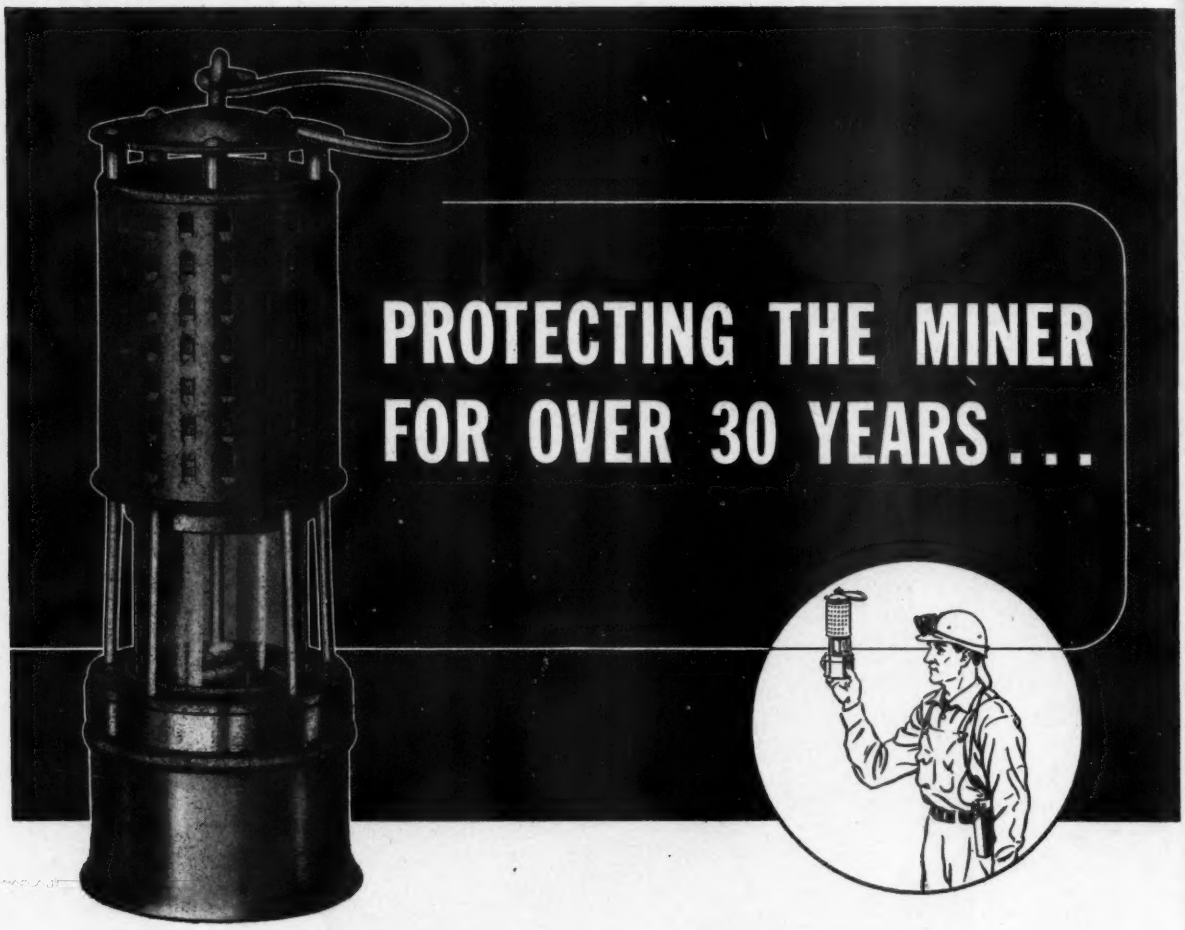
This is the fourth in a series of advertisements depicting the war-time role of Cummins Diesel Power in the nation's basic industries. If you are operating Cummins Dependable Diesels, you can assure their most effective use by making doubly sure that they are maintained and serviced—regularly and efficiently. Ask your Cummins Dealer for details.

WHEN buying mining equipment of any kind containing tapered roller bearings —cars, locomotives, conveyors, hoists—insist on seeing a sample of the bearings used and look for the trade-mark "TIMKEN" stamped on both *cup* and *cone*. If you see it you'll know exactly what you're getting.

When selling Timken Bearing Equipped mining machinery point out this trade-mark to the prospective buyer. Your selling time and cost—as far as the bearings are concerned—will end right there. One look—and no questions asked; such questions as: "Who makes them?" "Are they correctly designed?" "Has the bearing manufacturer had specialized experience in applying them to this kind of equipment?"

THE TIMKEN ROLLER BEARING COMPANY
CANTON 6, OHIO

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS



KOEHLER *Flame* Safety Lamp

The Koehler Flame Safety Lamp incorporates all of the requirements for essential safety and satisfactory operation needed in a safety lamp:

EFFICIENCY • ADEQUATE LOCKING DEVICE •
LATEST TYPE IGNITER • RUGGED CONSTRUCTION

The Koehler Flame Safety Lamp is fully approved by the United States Bureau of Mines—it has a perfect rating. Write today for new folder giving complete details—it will be mailed free.

MADE BY THE MANUFACTURER OF **WHEAT** APPROVED ELECTRIC CAP LAMP

SPECIALISTS IN MINE LIGHTING FOR 30 YEARS

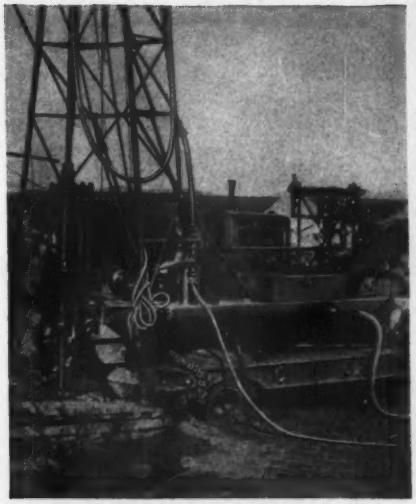
KOEHLER MFG. CO.

Marlboro • • • Mass.

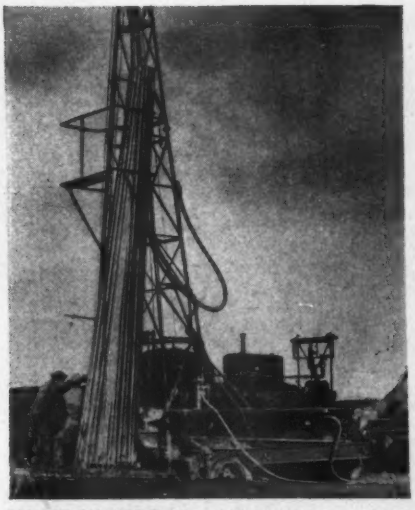
Eastern U. S. A.:
WHEAT LAMP SALES INC., Charleston, W. Va.
Western U. S. A.:
E. D. BULLARD CO., San Francisco, Cal.

Eastern Canada:
H. C. BURTON & Co., Hamilton, Ontario
British Columbia:
B. C. EQUIPMENT CO., LTD., Vancouver, B. C.

BETTER LIGHT - LESS WEIGHT
NON-SPILLABLE



THE HIGH-SPEED, PORTABLE DRILLING RIG is moved right up to the front lines by combat troops. The extremely flexible United States Rubber Company hose with which it is equipped is not only very strong but so much lighter weight than commercial hose made for similar purposes that there is a saving of several hundred pounds to be transported.



THE FIVE DISTINCT TYPES of United States Rubber Company hose supplied for the combat-zone drill rig are: high-pressure rotary hose; mud-suction hose, capable of being re-shaped if crushed; light, strong, wash-down water hose; high-pressure hose for hydraulic controls; oil suction hose for hydraulic system. These hose, as well as the special rubber valves, pistons and packings also supplied by the United States Rubber Company, are all specially designed to get water fast and to be tough for front line service.

"But You've Got To Drill For It!"

Thirsty work—plowing across blazing desert—slogging through murky jungle—crouching in the rubble of blasted towns.

Wherever they are, our soldiers get plenty of fresh water to drink. When it isn't in sight or when what's in sight may not be safe—you've got to drill for it, deep underground.

With the Army on the move, maintaining an ample water supply, sometimes under fire, means drilling fast, whipping away to another sector, drilling again. A tough problem in equipment, that! But it's been licked—rubber helped.

The George E. Failing Supply Company of Enid, Oklahoma, in conjunction with the U. S. Army Corps of Engineers, designed the needed high-speed, portable drilling rig. Working with them, United States Rubber Company provided various types of special hose—rugged enough for this rough, tough service but extra lightweight to keep pounds at a minimum.

United States Rubber Company engineers have aided many manufacturers in their problems of supplying articles of rubber for direct warfare use by the Armed Forces . . . as well as rubber equipment for plant production, safety and protection uses.

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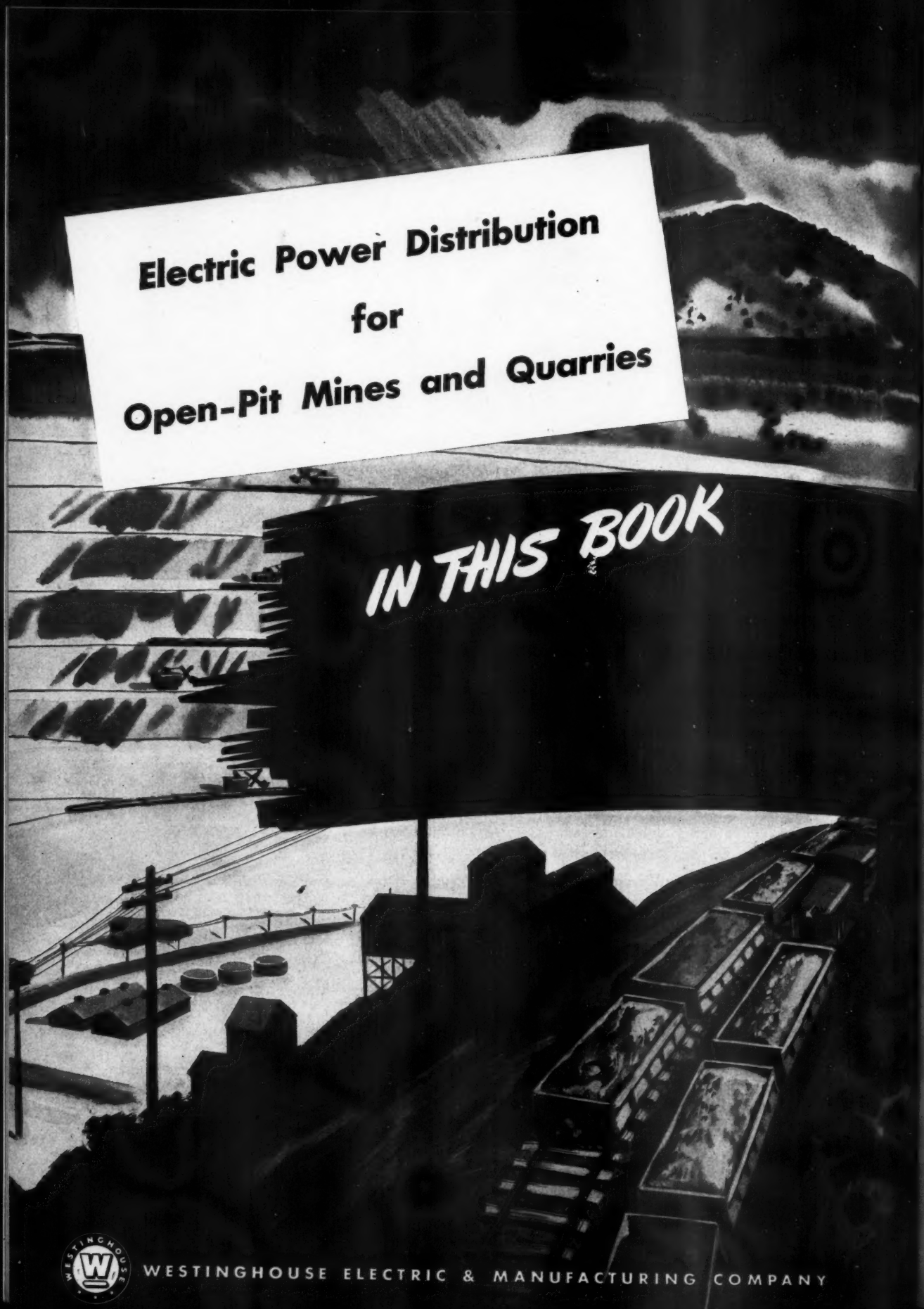
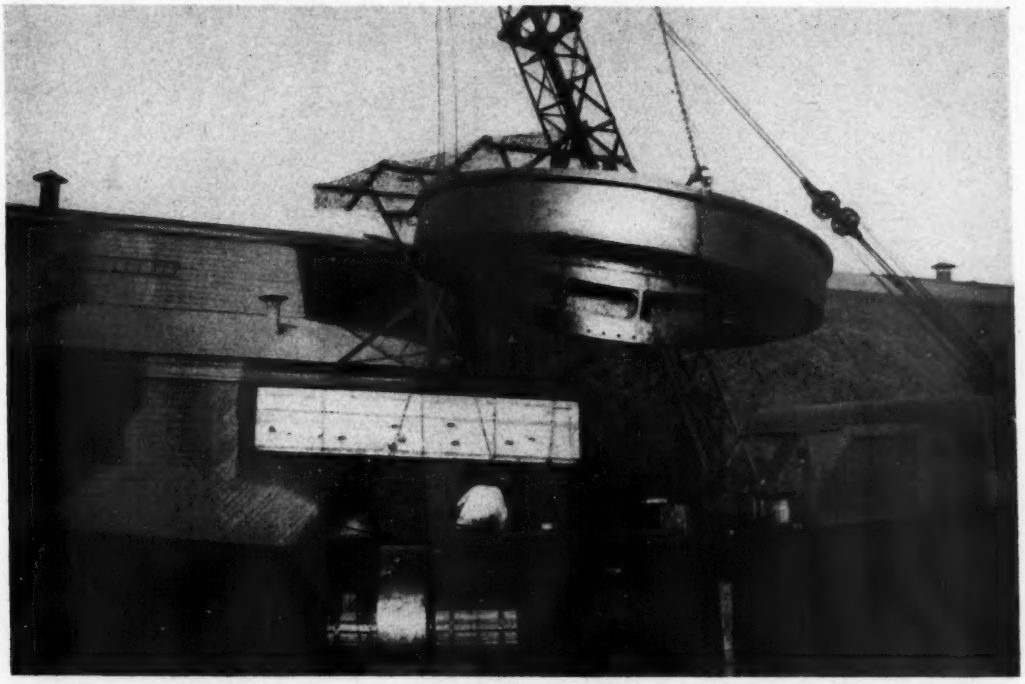


WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

YUBA SERVES INDUSTRIAL AND WAR FRONTS



Loading out dredge parts and Howitzers at Yuba Manufacturing Company's plant

Yuba's war assignment is far removed from its regular business but long manufacturing experience and a staff of skilled engineers and mechanics made it possible to expand the Plant and convert to war work without a day passing when some work of a critical nature was not accomplished. Today, Yuba is meeting the requirements of a production schedule established by Army Ordnance making 155 mm. Howitzers. Yuba's first Howitzer was delivered just a day less than a year after being authorized to proceed. During that period, shop facilities were expanded and a start made in training a large group of new employees, many of them former dredgemen. Also, a large volume of repair work for the United States Navy was done in the Yuba plant and parts have been furnished for dredges permitted to operate and producing critical materials. The Howitzer production steadily increased as special equipment and materials became available. New employees include about twenty-five percent women who soon earned the right to their official designation of "WOWS" (Women Ordnance Workers).

Yuba has won the reputation of turning out one of the best guns now in United Nations production. At an eastern Army Ordnance Proving Ground, it is referred to as that "Yuba gun" and rated as a "dandy." As Yuba serves on two fronts, Industrial and War, it continues to gain valuable experience and, at the same time, to lower costs on the Howitzer job beyond all expectations. After the war is won, there will be new Yuba dredges for the placer fields of the world. If your plans for the future include dredging for metals, let Yuba offer suggestions based on its many years of daily association with dredge operators plus the services of a skilled designing staff. If you are operating a dredge today, Yuba can furnish parts on orders accompanied by priority or allotment numbers.

YUBA DREDGES — PROVED DEPENDABILITY AROUND THE WORLD

YUBA MANUFACTURING COMPANY

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ENGINEER

SUPERINTENDENT

MINE OPERATOR

They're telling you!

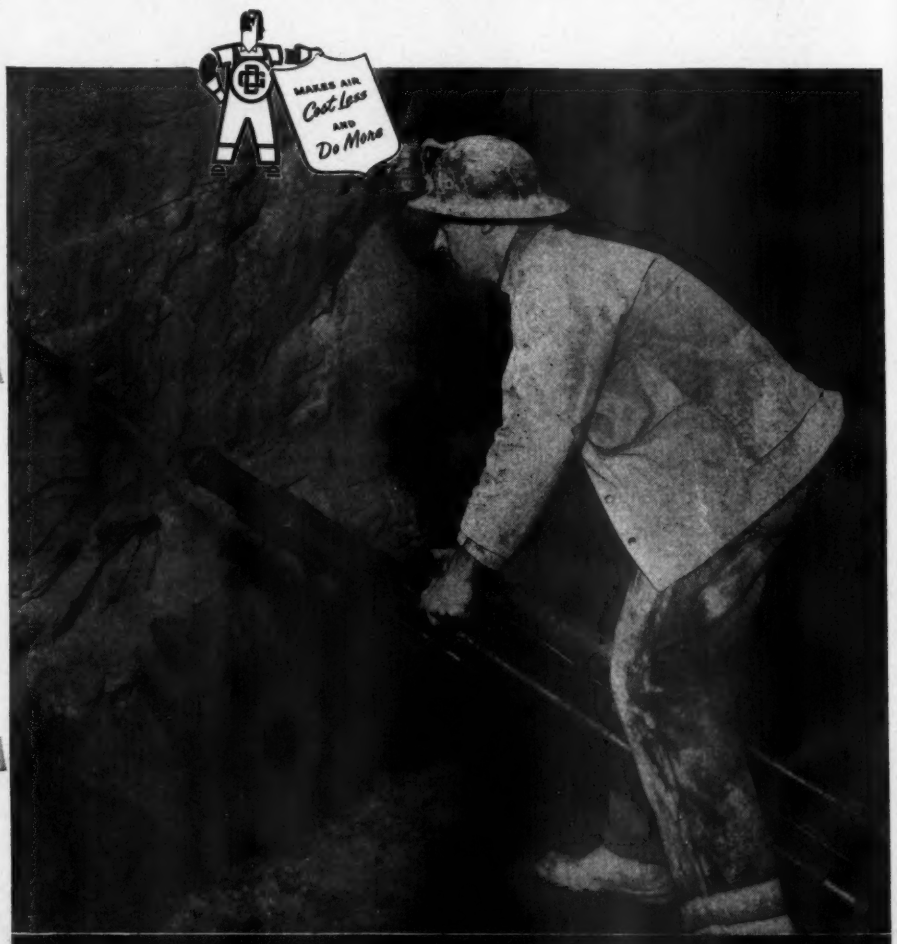
DRILL runners—engineers—operators! They've told us *why* they prefer the Gardner-Denver "R-104" Stoper.

Drill runners tell us that it's a better built stoper—that there's no pull on the holding handle—that the drill, not the drill runner, fights a tight bit.

Engineers praise the fully automatic system of air cleaning which ejects all sludge and water from the steel and front end of the drill. They have found, too, that this drill has plenty of extra power for faster drilling, even in the hardest rock.

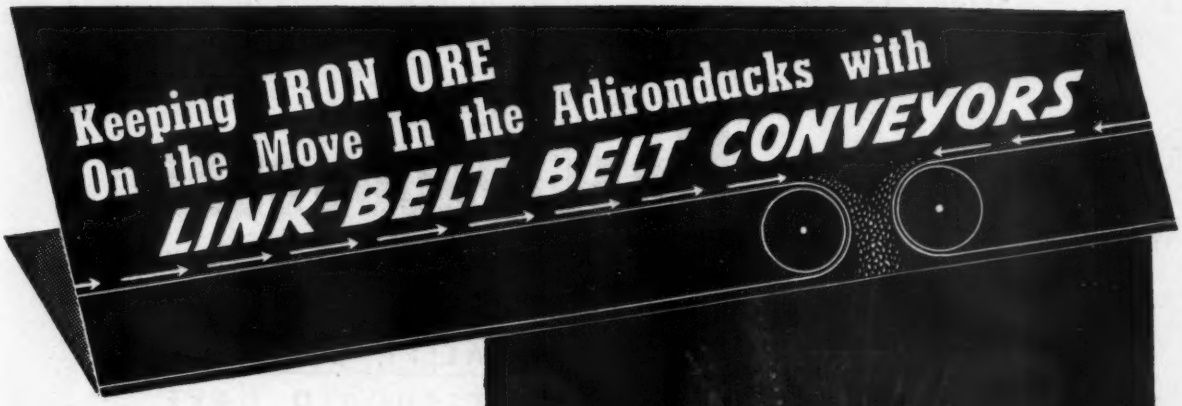
Operators prefer the "R-104" because it is so popular with their drill runners—because it means more footage per shift—because its dependability means lower operating costs.

Investigate the Gardner-Denver "R-104" Stoper. Write Gardner-Denver Company, Quincy, Illinois, for complete information.



GARDNER-DENVER *Since 1859*

Keeping IRON ORE On the Move In the Adirondacks with LINK-BELT BELT CONVEYORS



Clifton Mines . . .

● All conveying at Hanna Ore Co.'s Clifton Mines—through crushing, cobbing, concentrating and sintering operations—is accomplished with Link-Belt belt conveyors. Anthracite coal, used in the sintering operation, is also handled on Link-Belt belt conveyors. Other Link-Belt equipment includes drives; shaking, apron and flight feeders, and car movers. A Link-Belt Speeder shovel-crane, the boom of which is shown in the general view below, reclaims ore from storage to R.R. cars and trucks and handles coal from and to storage.

MacIntyre Mines . . .

25 Link-Belt equipped belt conveyors and a number of bucket elevators handle materials at this new titaniferous iron ore development of National Lead Company.

4-track Link-Belt built loading station, with enclosed 524-ft. long belt conveyor to where ore is carried in R.R. cars about 30 miles from mine.

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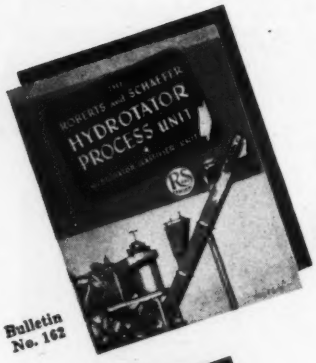
COAL PRODUCERS

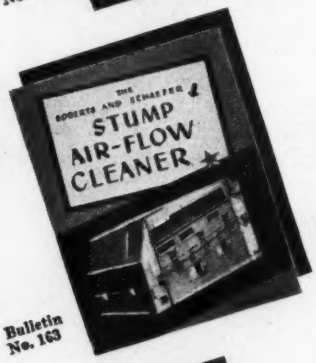
INTERESTED IN LOWERING COSTS AND IMPROVING THE QUALITY OF THEIR PRODUCT SHOULD HAVE



Bulletin No. 162

Bulletin No. 161

These New Bulletins



Bulletin No. 163

Bulletin No. 160

Coal that is adequately prepared, accurately sized, and efficiently cleaned, will be in the best "SPOT" for big demand in the post war markets.

Now is the time to bring your coal preparation methods up to date—thereby lowering the cost and improving the quality of the product.

That's where R and S come in—a seasoned organization of engineers skilled in designing and erecting modern coal preparation plants, or modernizing existing ones.

A practical suggestion, that will not obligate you, is to have Roberts and Schaefer survey your plant and submit a recommendation. Make a good start by writing us for the literature shown here.

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REVIEW

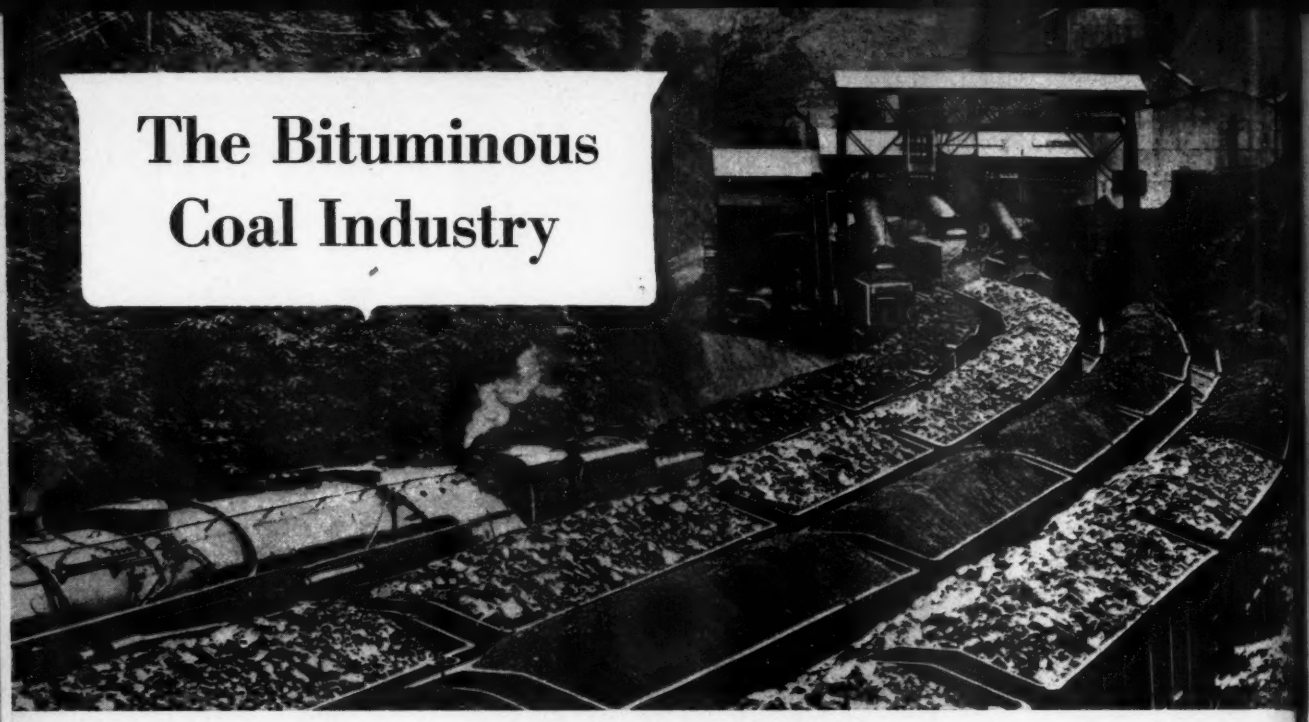
and

OUTLOOK

for

MINING

The Bituminous Coal Industry



Production record of 589,000,000 tons established despite loss of 30 or 40 million tons due to work stoppages. 1944 demand to be greater.

By R. E. HOWE
President, Appalachian Coals, Inc.

NINETEEN forty-three, all considered, was a year of great accomplishment on the part of the coal industry. Despite the fact that it was beset by strikes — four major stoppages and almost a continuous stream of lesser cessations of operations— 589,000,000 tons of bituminous coal were mined. This is the highest production on record. However, strikes and absenteeism made it impossible for the coal producers of the nation to meet the goal which they had established for themselves for 1943. The goal was a much higher production than was attained, with the idea in mind that the nation's coal requirements would be met fully and with plenty to spare.

However, strikes caused the loss of some 30 to 40 million tons of coal, thus nullifying, to a large measure, the thoughtful consideration and careful preparation of the industry and its customers. On May 14, 1941, Appalachian Coals, Incorporated, strenuously advocated by national advertising, a stocking program. We said in part: "The MOST IMPORTANT MATERIAL in our National Defense Program—is Coal! In your own interest, as well as in the interest of National Defense, it is imperative that as much coal as possible be speedily placed in storage in homes and in industrial plants — while operating and transportation conditions are most favorable." This was followed in 1942 by other interests and Governmental agencies.

As a result of this plan and the cooperation of the industry's customers, stockpiles were accumulated at a rapid rate. Thus, at the close of 1942, consumers, not including household users, held 85,889,000 tons of bituminous coal. This large supply was divided as follows: Industrial users—75,699,000 tons, retail dealers—10,190,000 tons. Any prudent businessman would have concluded that this was a safe and adequate supply margin.

It is indeed fortunate that such a safety margin was available at the beginning of 1943. Stoppages in the mines curtailed operations, limiting current distribution. As the year progressed, severe local shortages, and particularly shortages of special purpose coals, occurred. It was then necessary for a system of emergency distribution to be established. The first and most successful distribution program was developed and recommended by District 8 producers. It was worked out upon a voluntary basis and recommended by the industry. It made possible, by orders of SFAW, the meeting of practically every need placed upon it.

Toward the end of 1943 conditions became more critical, instead of better, and it was necessary to reduce sharply our safety margin stockpile. As we entered 1944, these inventories were down to about 57,000,000 tons. Also, this inventory above ground was rather badly maladjusted. Industrial consumers had only about 52,000,000 tons, but worse still, retail dealers had only in the neighborhood of 5,000,000 tons, or one-half the amount they held a year earlier. But, storage in householders' basements had increased materially. Inventories were further maladjusted in another sense. Many areas had in past years been dependent upon truck shipments which were no longer available. With their original source of supply gone, inventories in these areas dwindled and it was necessary for all-rail shippers to meet the emergency.

And even this attempt to meet emergency situations that arose relative to domestic coal was handicapped as a result of the ambitious lake program, which although necessary, had to be completed in a much shorter period of time in 1943 than in other years. Extreme weather conditions prevented the opening of the lake season as early as usual. Only about

half as much coal was moved to the lakes during March and April as normally.

The domestic picture is further aggravated by the colder weather experienced to date during the 1943-44 heating season. Up to January 1, this year, it had been about 7 percent colder in the North, 14 percent colder in the South, resulting in 9 percent more fuel burning weather east of the Mississippi River. This has, to some degree, nullified the larger movement through retail dealers into domestic consumers' bins. Domestic consumers, we estimate, actually took into their bins some 14,000,000 tons more coal during 1943 than during 1942. This was about a 15.4 percent increase as compared with 1942, and was almost 42 percent greater than the last ten-year average. Fortunately, these larger holdings of domestic consumers is making the retailers' position much easier than it would otherwise be during the balance of the 1943-44 heating season, and it is our belief that, with some exceptions, the domestic consumer will be cared for. The same statement can be made with regard to our industrial customers.

Forecast for 1944

More coal will be required during 1944 than was produced in 1943. Unlike the month to month pattern of 1943, however, the peak for the year probably will be established during the first quarter, with the demand and required production gradually but slowly declining during the balance of the year.

In making the above statement and the forecasts which follow, we are assuming that the war in Europe will continue at least into the latter months of the year, but even if the war were to continue longer than this, the trends in 1944 would not be materially different than we have here indicated. The reason is that our industrial capacity has now been reached. Supplies of materials for war will, according to officials, be at a point within the next month or so where some rather substantial cut backs in production schedules will be required. This does not mean, however, that reconversion will take place immediately or on any large scale. Plants, for the most part, simply will stand by ready for emergency production. Naturally, this means reduced coal requirements.

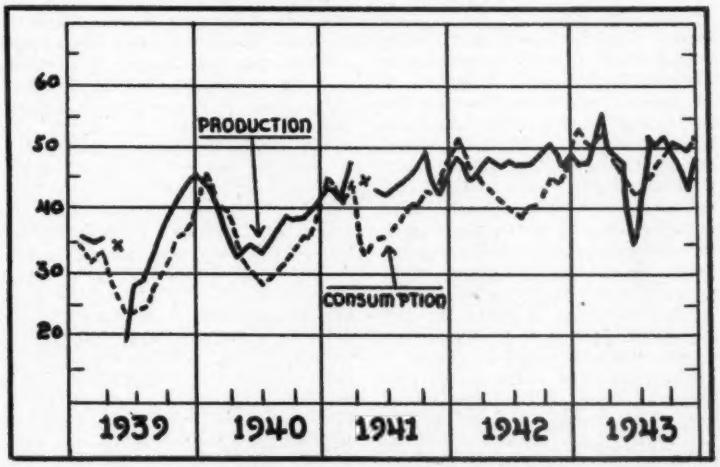
Steel and By-Product Requirements: Particular emphasis should be placed upon the prospects for the steel industry. It is forecast currently by the Regional Shippers Advisory Boards and officials in the steel industry that production after the first quarter will be reduced substantially. It is estimated that activity in the steel industry will be reduced to 90 percent to 95 percent of capacity. (The industry is now operating at 99.6 percent.) The above figures, however, are averages expected for the year. It is estimated that almost full capacity will be required for the first quarter. Therefore, in order to get an average of 90 percent to 95 percent on the full year, the industry necessarily would be curtailed considerably more during the balance of the year.

Largely dependent upon the steel industry, the demand for by-product and beehive coking coals will begin to decline during the second quarter and continue in a moderate down trend during the balance of 1944. It must be remembered, however, that current operations in the steel industry and current demand for coking coals are substantially higher than was the case in the early part of 1943. Thus, while we are forecasting a drop from current levels, the average for the year should not be more than 3 percent below the total consumption in 1943.

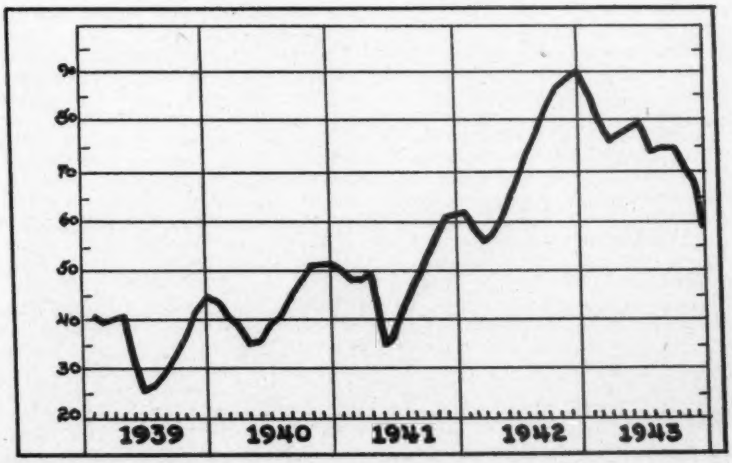
Other Industrial Requirements: The "other industrial" demand for coal has increased spectacularly during the last several months because many special new plants producing new products have come into operation. For example, Koppers' plant at Pittsburgh, producing synthetic rubber, now in full production, requires nearly one-half million tons of coal per year. There are similar plants scattered throughout the nation.

REVIEW and OUTLOOK for MINING

BITUMINOUS COAL
PRODUCTION VS. CONSUMPTION



..... TOTAL BITUMINOUS COAL STOCKS .....



INDIVIDUAL INDUSTRY COAL REQUIREMENTS FORECAST

	1942 Millions of Tons	1943 Millions of Tons	Percent Change	1944 Millions of Tons (Estimated)	% Change from 1943 (Estimated)
Utilities	65.6	76.4	16.5	80.0	4.7
By-Product	88.1	90.2	2.4	88.0	-2.4
Beehive	12.7	12.5	-1.6	12.0	-4.0
Steel & Rolling Mills	10.4	11.3	8.7	10.5	-7.1
Gas Retorts	1.7	1.6	-5.9	1.5	-6.3
Cement	7.5	5.9	-21.3	5.0	-15.3
Other Industrial	131.6	140.9	7.1	143.0	1.5
Railroads	115.4	129.4	12.1	130.0	0.5
Total Industrial	433.0	468.2	8.1	470.0	0.4
Dealers' Deliveries	104.8	120.9	15.4	105.0	-13.2
Total Consumption	537.8	589.1	9.5	575.0	-2.4
Exports and Misc. (Est.)	19.0	27.0	42.1	30.0	....
Total Demand	556.8	616.1	10.7	605.0	-1.8
Change in Stocks	23.2	-29.0	....	....	....
Production	580.0	587.1	1.2	....	....

There should be no cut back in the operation of these plants even if the war is to end sooner than is now contemplated. Our appraisal of these conditions indicates that "other industrial coal requirements" will show a gain for 1944 of about 1.5 percent as compared with 1943.

Utility Coal Consumption: During the first half of 1943 precipitation conditions were quite favorable to hydro-electric power production. The larger proportion of the total increase in the demand for electric power was supplied by hydro plants. Drouth conditions later in the year, however, forced a sharp curtailment in hydro-generated electricity, resulting in a sharp increase in the demand for coal. As a result of these conditions and substantial increased demand for power, utilities for the full year, 1943, took 16.5 percent more coal than they did in 1942. There is no indication that these conditions will change much for 1944, and hence, utility requirements for 1944 may be at a monthly rate close to that of the last half of 1943. This would indicate an increase in 1944 coal requirements of utilities of about 4.7 percent, increasing their demand to a total of 80,000,000 tons.

Coal Use By Railroads: With the war effort near its peak and cut backs in production schedules indicated, little further gain is anticipated in traffic. In fact, there may be no increase in railroad freight traffic inasmuch as those production schedules which are projected to rise further in 1944 involve such things as aircraft, which will be flown away, or will require little transportation. In our estimate, therefore, we allow for an increase of only 0.5 percent in the coal demand of the railroads.

Total National Industrial Needs: Summarizing, the total industrial demand for coal in 1944 will approximate 470,000,000 tons, or 0.4 percent above the 468,200,000 tons consumed in 1943. This, we believe, is a maximum prospective demand. It is a demand based upon practical maximum productive capacity of all important coal consuming industries of the nation. An earlier end of the war in Europe would have a decided effect in lowering this forecast.

Dealers' Deliveries Projected: 120,900,000 tons of coal were delivered through dealers during 1943, representing an increase of 15.4 percent over the deliveries of 1942. We know that some excess coal was accumulated in household bins during 1943. Even with a degree-day pattern some 5 percent beyond the last ten-year normal, as is now indicated, there could be a further substantial accumulation of inventory in householders' bins during the next several months, because the public, being definitely coal conscious, will attempt to maintain larger supplies than normal. We believe, therefore, that dealers' deliveries in 1944 will be somewhat less than in 1943, although they will be more than in 1942. Tentatively, we have estimated such deliveries for 1944 at 105,000,000. While this figure is 13.2 percent below the 1943 total, it is almost 24.2 percent greater than the last ten-year average.

There is another quantity of coal for which individual figures are not available to the public. This tonnage includes such items as exports, military fuel requirements, etc. Subtracting the known consumption from our total production and allowing for the change in inventory, this item, which we will term "exports and miscellaneous demand," amounted to 19,000,000 tons in 1942, increased to 27,000,000 tons in 1943, and will be about 30,000,000 tons this year.

Conclusion

There is no question as to the huge demand that will be placed upon the bituminous coal industry during 1944. The over-all demand for coal during 1944 on the basis of the estimates made herein will be in the neighborhood of 605,000,000 tons. This represents a decline of 1.8 percent from the preliminary estimated over-all demand of 616,100,000 tons during 1943. It is, however, a sharp increase over the 1942 figure of 556,800,000 tons. This demand is so great that we can safely forecast that maximum production will be required.

But, there is some question as to exactly what maximum production can or will be. While we do not have statistics available relative to the entire national situation, we can draw some conclusions based upon the facts which we do have at hand.

When we adopted the six-day week in February, 1943, we experienced a rather sharp increase in production but gradually the rate of gain obtained by the longer work week diminished. In July, 1943, output on the basis of the six-day week appeared to have been stabilized. As a result, although the worktime schedule in District 8 was 20 percent greater, coal production for the July-August period was only 7 percent more. This agrees approximately with other producing areas.

Naturally, the question arises as to how much production might increase as a result of the November, 1943, upward revision in working time. Hours have been increased 14 percent. If we can assume the same relative growth in production as was experienced when we expanded from a five- to a six-day week basis, it would be reasonable to expect a further sustained increase in production of about 3 percent.

However, our mines were operating only five days a week during the first six weeks of 1943. Actually, during the first half of the first quarter of 1944 mines will be working 35 percent longer than they were in the corresponding 1943 period. During this period the net increase in national production, based upon our experience in District 8, should be in the neighborhood of 12 percent (we have not yet attained production quite as high as would be thus indicated). However, during the second half of the quarter our increase in output should be only 3 percent. On average, total production for the first quarter of 1944 should rise between 5 percent and 6 percent. An average weekly production of 12,000,000 tons for 51 weeks (holidays eliminated) would result in an output of 612,000,000 tons for the year. 12,500,000 tons per week would produce 637,500,000 tons.

PROVIDED there is no further loss of manpower, especially to the draft; no further strikes, a return of managerial and supervisory functions of the industry by both the Government and by the Unions; and provided further, that there will be adequate supplies and equipment for both the mines and the railroads, we believe the above indicated 1944 demand for coal will not only be met but substantial amounts added to inventory.

Trends in Mechanical Mining of Bituminous Coal

War period slows development of mine equipment. Loss of skilled men forces attention on underground management and labor-saving auxiliary equipment.

By L. E. YOUNG
Mining Engineer

WHILE there were no substantial changes or improvements made in most of the mechanical loading devices employed in bituminous coal mines in 1943, considerable progress has been made in underground management and in the application of auxiliary equipment.

Throughout the industry many skilled men have been lost to the armed forces and serious difficulties have been encountered in securing adequate repair parts, supplies, etc. These handicaps have made it essential that all equipment be used efficiently during every available minute of the work-week and that supplies and repair parts be conserved in every practical way.

Due to the increased demand for coal, there never has been a time when there was greater need for mechanics skilled in maintaining and repairing equipment on the job, and yet the supply of experienced men has been reduced greatly on account of the war situation. Therefore, more attention has been given to current inspection of equipment, lubrication, prompt servicing of all equipment, elimination of delays in moving equipment, delivery of supplies, and recovery of material from worked-out sections. Management has met these challenges in a commendable manner.

New Equipment

Manufacturers have not been able to furnish new designs and models and make deliveries as promptly as desired, but there has been progress along several lines in the development of auxiliary equipment that has served to reduce the labor force required for miscellaneous duties.

Among the new equipment and improvements worthy of note are:

1. Rubber-tired tractor and truck for moving miscellaneous tools and equipment that is not self-propelled.

2. Rubber-tired high-pressure rock-dust distributor.

3. Track and rubber-tired lubricating truck, that can also be made to serve as an electrician's and mechanic's repair truck.

4. Mine jeep for transporting mine officials, mine electricians, mine surveyors, etc., where track and trolley are installed.

5. Shortwall mining-machine truck arranged with water-spraying apparatus in the base of the truck.

6. Timber-setting machine.

7. Specially-designed self-propelled equipment for recovering mine timber.

8. Portable hoists designed for moving conveyor-drives, etc., in working sections of low-height mines.

9. Gobbing-conveyor (mounted on track or tires) for use, in connection with a loading machine or shuttle-car, in stacking waste material.

Entry Driving

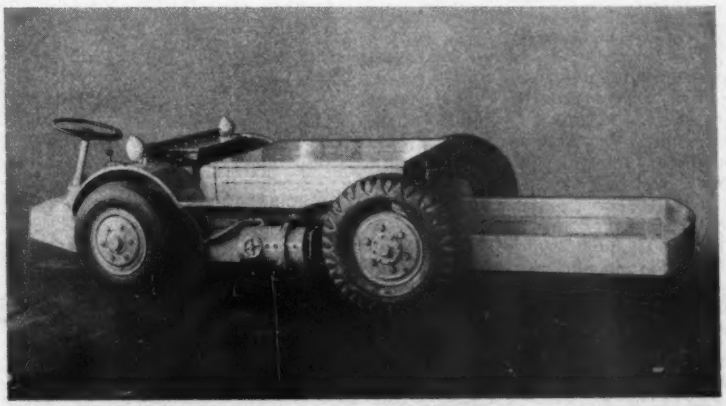
The increased production has required the driving of a large amount of entry, both main and panel, and in order to keep this work in step with room-and-pillar mining, more thought is being given to the scheduling of entry work. Commendable improvement is being made in the orderly advance of entries with conveyors, mobile loaders, shuttle-cars, and other devices.

Following are some of the reports received recently from representative operations to show the rate at which entries may be advanced although, because of various handicaps from manpower shortages, work stoppages, etc., the year 1943 has not been one in which many speed or production records have been broken.

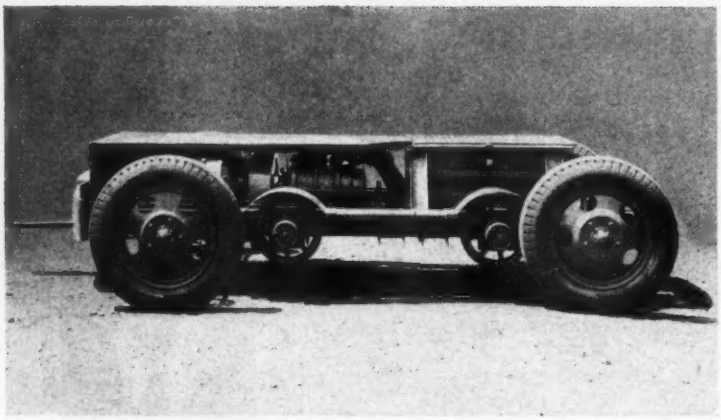
An *Entry Driving Machine* which consists of two rotating cutter bars is averaging 52 ft. each operating shift.

A *Cutting and Loading Machine* which operates somewhat along the principle of a short-wall cutter, makes an average of eleven 5-ft. cuts per day of two shifts and an advance of 1,000 ft. of single entry requires about 40 operating shifts.

A *Mobile Mechanical Loader* in a 7-ft. seam driving a set of three main entries, averaged three 8½-ft. cuts per shift in each entry and on a two-shift



Rubber-tired tractor and truck for moving miscellaneous tools and equipment



High pressure rock dust distributor, pneumatic mounted

operation drove each entry about 50 ft. per day.

A *Mobile Mechanical Loader* in a 42-in. seam developing a set of seven entries, reports an average of 13 places loaded per shift, each place being undercut 8 ft. This made a total of 104 ft. for the seven entries or about 15 ft. per entry in a single shift. This operation works double shift.

A mobile mechanical loader developing a set of 7 entries advanced each heading 1,275 ft. in 64 days on triple shift. There was a total of 12,951 ft. of narrow work driven in this period—8,925 ft. of entry and 4,026 of cross cuts.

A mobile mechanical loader in a 6-ft. seam drove a total of 16,316 lin. ft. of narrow work in 147 shifts—an average of approximately 111.3 ft. per shift.

A duck bill loading operation, developing 3 parallel entries advanced each heading at the rate of 20 ft. per shift or a total advance of 60 ft. in each entry was made per day of 3 shifts. The coal is 54 in. thick and has a 15-in. draw slate.

A duck bill mechanical loader in a seam 42 to 46 in. thick averaged 4½ cuts in each entry per 7-hour shift—a total shift advance of 31½ ft. per entry.

The foregoing data have been presented for the purpose of showing that (1) continuing progress is being made in the rate at which two or three entries may be advanced when it is planned to develop to the property lines and then mine retreating, and (2) the cost of coal produced in entry-driving may be kept reasonably low if proper and adequate equipment is provided and the work is scheduled intelligently.

Continuous Mining

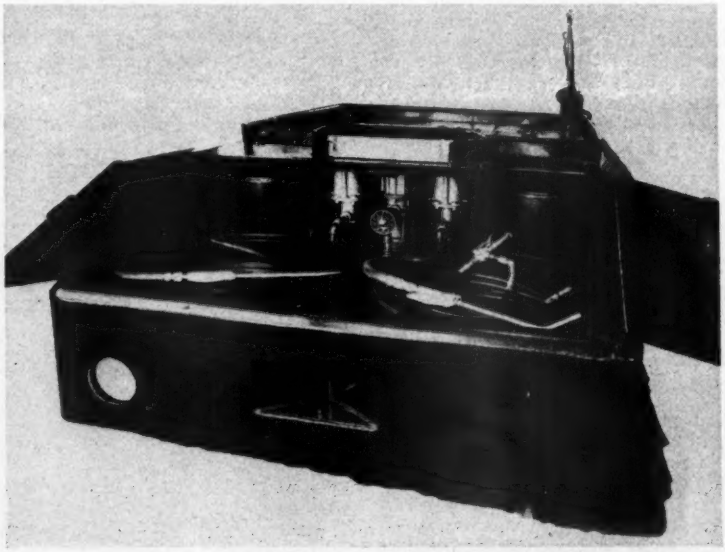
The operation of a number of mines on a multiple-shift basis has emphasized the importance of concentration of workings in order to avoid long moves of equipment and men. This has resulted in more careful scheduling of work in the active sections of mines. The normal cycle of cutting, drilling, shooting, and loading, together with the necessary timbering, track-laying, building of brattice and stopings, removal of parting or slate, making of falls in pillar-mining, handling of water and supplies, recovery of materials, extending of electric power lines, rock-dusting, etc., does not permit a continuing flow of coal from one face, using standard equipment now available. The long search for a combination cutting-and-loading machine that will require no shooting of the face has not been successful, except for the McKinlay Entry-Driving Machine, which thus far has had only limited application.

The nearest approach to continuity of operation has been achieved by three different types of operation:

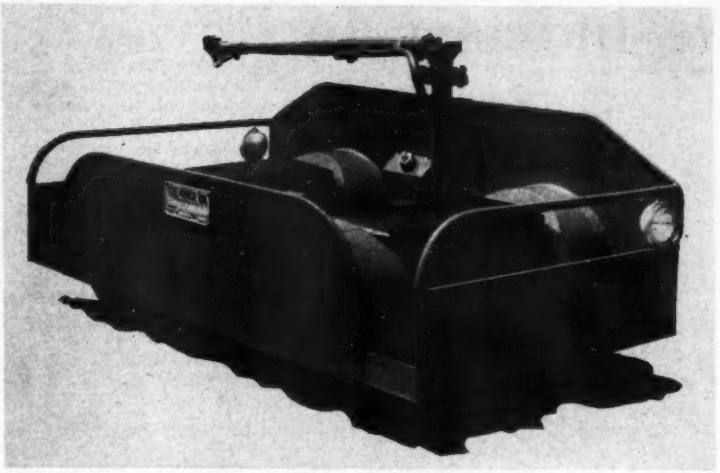
1. The Jeffrey cutter-and-loader (which is a modernized Shortwa-loader) undercuts and loads as the machine moves, like a shortwall undercutter, across the face. The bug-duster and driller can work across the face following the machine. After the machine has finished the cut and has been moved back to the right-hand rib and sumped in, the face is shot and the cycle is repeated. The coal is loaded by the machine onto a conveyor which is extended during the time the machine is being moved to the right-hand rib. By performing the cutting and loading operations simultaneously, a substantial saving in time results.

2. In advancing rooms with the Goodman shaking conveyor and automatic duckbill, the shortwall undercutter and the electric drill may start working as soon as the right corner of the room has been loaded out and the duckbill has advanced a safe distance from the right-hand rib. In well-managed operations where roof conditions are favorable, a considerable saving in time and effort has been secured by intelligent planning. The extending of the conveyor, moving of equipment, removal of bug-dust, loading shot-holes, changing cutter-bits, placing of roof-supports, and handling supplies can be scheduled effectively. While this type of operation, like the type described in Number 1, is not continuous mining, it permits a small crew of men to produce a reasonably uniform tonnage without severe manual labor.

3. The mobile loader, working in two places, served by conveyors or shuttle-cars, permits a small skilled crew to produce a relatively large tonnage with a minimum of delay in travelling and moving. Generally the cutting,



Lubricating truck—can also serve as utility repair truck



Mine jeep for transporting persons inside mine

drilling, bug-dusting, and shooting are done by one small crew and the loading, timbering, and extending of conveyors (if used) are assigned to another small crew. With trained men rapid advance of faces and a good tonnage per man may be secured.

Trends

While no new designs of equipment have been announced during the war, substantial progress may be expected in the way of new types of equipment in the post-war period. It is likely that there will be

1. New models of low-height machines for loading into mine cars, shuttle-cars, and conveyors.

2. Improved shuttle-cars of various types.

3. New mountings of cutting machines for trackless mines.

4. Mechanism for moving bug-dust away from undercutting machines.

5. Improved drilling equipment for trackless mines.

6. Conveyor drives, etc., built so that the units may be moved more easily. Auxiliary equipment is being perfected for moving conveyor units.

7. Improved equipment for servicing and maintaining all types of face machines, conveyors, etc.

The large increase in belt transportation indicates that loading machines, shuttle-cars, and auxiliary equipment will be modified and adapted to meet this trend.

It should also be noted that at last there is being accepted by several of the largest coal operating companies and by official inspection departments, a fundamental idea that was recognized many years ago by pioneers in mechanization, namely, that mining methods and mining plans must eventually conform to the practical mechanical design of loading devices, rather than the idea that the loading device cannot be used unless it conforms in every way to the existing mining practice and mining plan. Standardization—sometimes in the use of obsolete methods and machines—has long been an obstacle to progress in certain quarters, and now that it has been demonstrated that mechanized mining can be made safer than hand mining, it is to be hoped that the coal mining industry may be permitted to take full advantage of new devices and new methods.

The introduction of American loading machines, conveyors, and cutting machines in European mines, under Lend-Lease, should result in a wider market for American machinery after the war. The American coal operator will undoubtedly benefit in the long run because better equipment will be developed as a result of this overseas experience of American manufacturers.

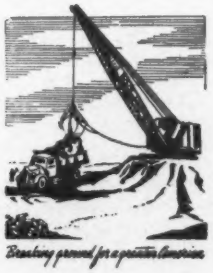
REVIEW and OUTLOOK for MINING

Bituminous and Lignite from Strip Mining

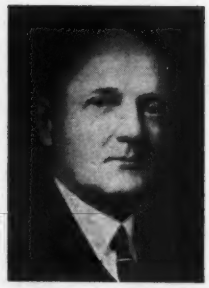
EACH YEAR strip mining continues to play a more important part in producing the fuel requirements of our country, and in 1943 the open pits contributed 70,000,000 tons of bituminous coal—which amounted to 12 percent of the total U. S. production. These figures, however, are only a part of the story. The total bituminous production of 589,000,000 tons in 1943 was an increase of 9,000,000 tons over the 1942 period; the strip mine production of 70,000,000 tons was 7,000,000 tons over the 1942 figures, so it would seem that the open pit industry was largely responsible for the 9,000,000 tons increase in 1943.

The progress of strip mining during the past year has followed two entirely separate trends. One is what might be called the conventional development which means the installation of new equipment, large capacity shovels and draglines, as well as the construction of new cleaning plants and additions to present preparation facilities. The other line of development has been through the employment of road-building machinery; since Pearl Harbor, highway construction has been virtually at a standstill, and much road equipment which was lying idle—such as power shovels, trucks, bulldozers and scrapers—has been diverted to stripping small outcrop areas.

This trend has been particularly noticeable in the northern and eastern Appalachian Field. Complete statistics for 1943 are not available, but preliminary figures for West Virginia are indicative of this general section. In that state the number of strip operations has been increased from 17 in 1941 to 115 in 1943 and their production was raised from 1,000,000 tons in 1941 to 4,000,000 tons in 1943. For the most part these pits are small producers, working limited areas and it is hardly probable that many of them will continue as permanent operations. However, they have served and are still serving a very useful purpose in helping to supply coal for the war needs.



The Anthracite Industry In Review



By W. H. LESSER
Pierce Management
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Industry registers progress despite wartime tribulations which prevented attainment of production goal.

IN VIEW of the wartime demand for anthracite coal, a review of the anthracite industry for 1943 concerns first of all, the production; because there is no better accomplishment which measures the activity of the industry and its contribution to the nation's accelerated fuel requirements.

As shown in Table 1, the estimated 1943 commercial tonnage is 57,285,000 net tons, just under that of 1942. The total industry production will be about five million tons less than the 65 million ton requirement estimated by the Department of the Interior.

TABLE 1

Year	Days Worked	Commercial Production Net Tons
1932	162	46,447,000
1933	182	46,584,000
1934	207	54,042,000
1935	189	49,412,000
1936	192	51,874,000
1937	189	49,184,000
1938	171	43,786,000
1939	183	49,073,000
1940	186	49,229,000
1941	203	54,107,000
1942	239	58,289,000
1943 estimated	265	57,285,000

Even though the production record is a disappointment, it represents a decided effort on the part of industry management to meet the demand for more coal. Lack of manpower, absenteeism, less efficient and older workers, together with a loss of around 3,000,000 tons through strikes, have affected adversely the production forecasts made at the beginning of the year. On the other hand, numerous small breakers, Figure 1, helped to augment the tonnage. Plants in this class, at first, depended largely upon bootleg coal, but with the decline of that industry a certain production was maintained with coal purchased from stripping operators.

Current industry production would be difficult to attain without coal obtained from strippings, refuse banks, and bootleg operations. The output from mines continues relatively low on account of the reduction in development expenditures during the years just passed.

Several mining companies, eager to meet the demand for coal, showed an appreciable increase in production as compared with 1942. They were, however, ordered by the Solid Fuels Administration to divert a portion of this increase from their regular customers to areas where shortages developed.

Labor

Negotiations with the United Mine Workers of America from April 1 to the latter part of the year, and the suspension of the mines during certain periods of the interim highlighted the labor situation in the anthracite coal mining area. The demand for greatly increased wages and portal to portal compensation exceeded the standards of the little steel formula, consequently the negotiators were unable to settle their differences amicably. Then too, there was an unwillingness on the part of the labor union to keep their demands within the scope prescribed by the War Labor Board.

On May 1 and again on November 3, the Secretary of the Interior took over the operation of the mines to insure the production of coal so necessary to fight the war. After the latter seizure, a wage settlement was reached which was based upon the War Labor Board award, the Ickes-Lewis wage agreement, and retroactive pay. Although the application of the award to existing rates is not entirely clear, it seems certain to increase the daily pay per mine worker by about $1.

To offset the wage increase, the Office of Price Administration advanced the selling price of coal just in time to prevent a suspension of many mines on account of the lack of funds to meet increased payrolls. The price made effective by OPA as of November 24, 1943, failed to meet the increased anthracite costs by approximately 15 cents per ton, thus creating a serious financial problem for anthracite producers.

Figure 1

Manpower

The industry has experienced a serious reduction in manpower due primarily to the draft requirements, and the shift of workers to defense plants where a higher wage rate prevails. In 1942 when 58 million tons were produced, the necessary labor organization contained 96,000 men which declined to 76,000 toward the end of 1943.

Efforts have been made to shift mine workers from areas where a surplus exists to those where there is a shortage, but with varying success. Miners experienced in heavy pitch mining hesitate to work in mines where the coal is flat.

The War Manpower Commission recognized the seriousness of the labor situation when it authorized conferences having to do with the deferment of workers essential to maintain production quotas. Estimates indicate that 11,000 men are now in the armed forces, and a possible 29,000 within the draft age.

Preparation

The necessity of shipping coal with a quality to meet the standards of the industry resulted in the installation of much coal-cleaning equipment. Some of it went into the new smaller breakers originally built to clean bootleg coal which, to a degree, was hand-cleaned by the miners. An estimate of the coal-cleaning equipment placed in operation during 1943 is shown in Table 2.

TABLE 2

Name	Capacity of Cleaned Coal Per Hour Net Tons
Wilmot hydrotators and classifiers	325
Wilmot jigs	215
Chance cones	400
Menzie cones	280
Deister superduty diagonal deck tables	579
Total	1799

On account of the great demand for fine sizes, especially during summer months, much equipment was purchased to clean them. The Rhonda Coal Company built a plant containing four Deister superduty tables cleaning barley and No. 4 buckwheat. This plant is of interest to preparation engineers because settling tanks, instead of shakers, are used to size and dewater the coal.

The Gilberton Coal Company added a pre-cleaning plant to its breaker from which is now shipped more coal with a better quality. A main conveyor with feeders, shakers, a picking table, two pairs of rolls, and two roughing jigs were involved in the project.

A school for the study of preparation problems by breaker men was started by the Lehigh Navigation Coal Company under the auspices of the School of Mineral Industries, Pennsylvania State College. Oil flotation, heavy media, and processes depending upon settling velocities make it worthwhile to give breaker operatives an opportunity to study the scientific principles on which such cleaning processes are based.

Minimum quality standards for anthracite coal were established by the Solid Fuels Administration—domestic sizes not more than 15 percent ash by volume on dry basis, No. 1 buckwheat 16 percent ash, and No. 2 buckwheat 17 percent. To maintain these standards several federal coal inspectors have been appointed.

Stream Pollution

Interest in stream pollution quickened when the City of Philadelphia brought suit against a group of anthracite coal mining companies to restrain them from dumping silt into the Schuylkill River. Since not only silt, but also sewage and other industrial by-products contaminate Philadelphia's water supply; all interested parties look forward to the conclusion of Governor Martin's Committee appointed to study the problem. In addition to silt disposal plants located at the mines, these projects have been discussed: dredging the river for coal to manufacture briquettes; sewage disposal plants in towns along the river; prohibiting the dumping of industrial wastes into the river; and the procurement of a potable water supply for Philadelphia from the Pocono water-shed. The proposals involve the investment of much capital and the possible interruption of many industries.

Bootleg Industry

Many developments, together with pressure from the semi-official State Anthracite Committee, have so affected the bootleg industry that its organization in October, 1943, contained 2800 men as compared with 12,000 in 1942. After conferences with bootleg leaders, the Committee issued an ultimatum directing the operations to cease mining November 30, 1943. These important reasons justify the action: opportunities now exist for bootleg miners to work in legitimate mines, and their destruction of coal properties due to robbing barrier and reservation pillars.

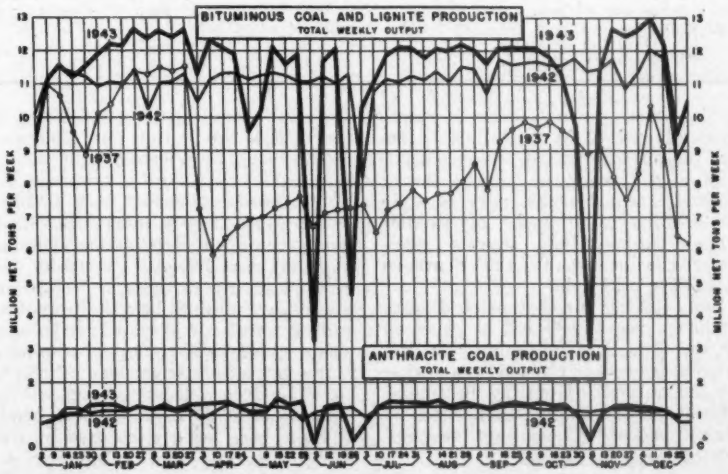
The independent miners were encouraged by Governor Martin who advised them to get leases on their properties, to pay royalties, and to develop their mines in accordance with safe mining practice. Then, too, the Schuylkill County Court dissolved a preliminary injunction and dismissed bills in equity brought by a State Mine Inspector to stop bootleg miners from operating gasoline engines in their mines.

As the end of the year approached, it appeared doubtful whether bootleg mining will cease as a major mining activity, even though the present conditions afford an excellent opportunity to stop it.

REVIEW and OUTLOOK for MINING

Strip Mining

Records show that strip mining began about 1881 with the introduction of steam shovels and increased steadily throughout the years. In 1942 there were approximately 400 shovels in operation producing 9,000,000 tons of coal, or 16 percent of the total production. In view of the new shovels placed in operation during the year,



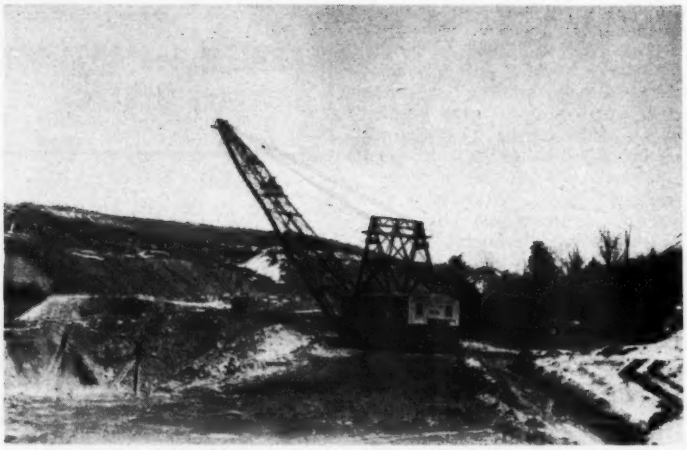


Figure 2

this class of mining has again increased appreciably.

As strippings become deeper and the ratio of overburden to coal increases, larger and more expensive shovels are necessary. An investment of $500,000 has been made in a single shovel. The Beechwood Stripping of the Philadelphia and Reading Coal and Iron Company under contract by the Coreale Construction Company of Hazleton will require a shovel with a 25-yd. bucket, a 180-ft. boom and 1750 hp in electric motors. Here a virgin basin of coal 70 ft. thick, 250 ft. below the surface will be stripped. Although the trend is toward larger shovels, a considerable part of strip run-of-mine is produced by smaller Diesel engine-driven shovels especially conspicuous in the Southern anthracite coal field.

Strip mining is so extensive, Figure 2, that a regulatory bill is expected by the State. A committee of the Legislature recently toured the region for the purpose of getting first-hand information regarding that class of mining and its concomitant destruction of the landscape.

A paper of outstanding merit, presented at a recent local meeting of the American Institute of Mining and Metallurgical Engineers, described in detail the technique of strip mining.

Pumping

Strip mining, pumping water from abandoned mines, and flash floods presented many interesting pumping problems. Their solution shows progress in the engineering of mine pumping plants. The water was pumped from the abandoned No. 5 Colliery of the Lehigh Navigation Coal Company by means of two centrifugal pumps each with a capacity of 5,000 g.p.m., 310-ft. head, suspended back to back on a 6½- by 11½-ft. mine cage. Each pump, equipped with non-overloading impellers was driven by a 400-hp. 25-cycle, 1,450-r.p.m. motor. Pumps of this type, Figure 3, have been applied quite generally in the anthracite area where their total pumping capacity represents an electrical load of 15,000 hp. Two deep well pumps each with a capacity of 2,700 g.p.m., 170-ft. head, in 18-in. bore holes were used by the Jeddo Highland Coal Company to pump the water from its Germantown mine. Surface topography, the location of Mahanoy Creek, water in an adjoining mine; all these conditions justified the foregoing type of pumping plant. The Jermyn Green Company removed the water from its John Veith Shaft by means of steel water tanks suspended on the ropes of a two-drum 900-hp. electric hoist.

For the purpose of pumping water from flash floods, the Hudson Coal Company has available at a centrally located colliery a 4,000-g.p.m. centrifugal pump, 450-ft. head, mounted on a steel mine truck with an adjustable wheel gauge. The entire unit can be moved quickly to a mine inundated suddenly with water. This company completed recently a project which consisted in sealing the cracks in the bed of a stream flowing over one of its mines. To do the work properly, it was necessary to change the channel of the stream temporarily.

Rehabilitations and New Companies

Regardless of the vicissitudes in mining anthracite coal, some 15 new mining companies were chartered, and several abandoned mines reopened. Prominent in the list of rehabilitated properties were the Loree Colliery of the Hudson Coal Company, and the recently acquired Germantown Colliery of the Jeddo-Highland Coal Company. The latter project involved the construction of several miles of railroad track, the opening of a double track gunboat slope, a precleaning plant, a deep well pumping plant, to-

RELATIVE GROWTH OF PENNSYLVANIA ANTHRACITE MINED FROM STRIP PITS, 1920 TO 1943

	Number power shovels in use (1)	Total tons strip coal	Average tons per shovel	Percent of fresh-mined total
1920	96	2,054,441	21,400	2.5
1925	97	1,578,478	16,273	2.7
1930	108	2,526,288	23,484	3.7
1939	346	5,486,479	15,857	11.4
1940	348	6,352,700	18,255	13.3
1941	(2)	7,316,574	(2)	14.3
1942	* 400	9,070,933	* 22,000	* 16.7
1943	* 450	9,900,000	* 22,000	* 18.4

(1) Certain equipment reported by stripping contractors may have been counted twice when moved from one small job to another during the year. The amount of such double counting is unknown but presumably is not great.
(2) Data not available.
* Preliminary estimate.

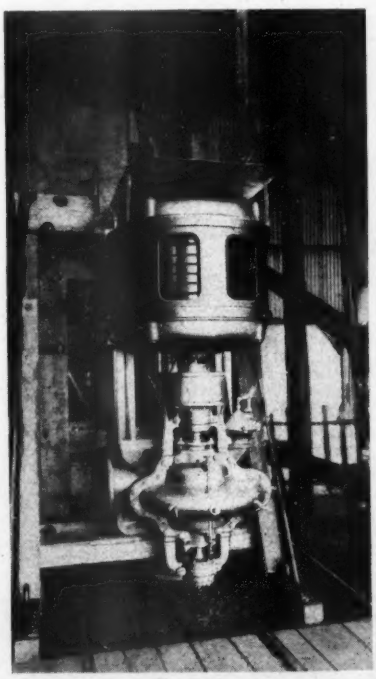


Figure 3

gether with the necessary colliery buildings. For the purpose of preparing the Germantown coal, the cleaning facilities in the company's adjoining Midvalley breaker were increased, and a new run-of-mine conveyor constructed.

A lease of 816 acres of coal land from the Philadelphia and Reading Coal and Iron Company to the Kalmia Coal Company forecasts the development of the abandoned Kalmia Colliery in the west end of the Southern Field. Several million tons of Lykens coal, long known for its excellent burning qualities, remain to be mined.

Two coal companies: The Oak Hill Coal Company, and the West Wood Coal Company were purchased by the Philadelphia and Reading Coal and Iron Company which is in a favorable position to furnish a much needed tonnage to the breakers thus acquired. Shipments from these properties helped the Reading to meet its most pressing demand for coal.

Instances of the current movement of operators from the Northern to the Southern Field were: Moffat & Schrader when they acquired the Primrose Colliery from the Susquehanna Collieries Company, and the Jermyn-Green interests when they reopened the John Veith Colliery abandoned in 1918.

A start was made at Hauto, Pa., on the construction of a breaker by the Landene Corporation, a Pierce Management project. Several large banks will be reclaimed from which shipments of 1,000 tons per day are anticipated.

Surface Subsidence

Serious mine caves in populated areas resulted in conferences of the State's Anthracite Subsidence Commission and representatives of the anthracite industry. These remedial proposals were considered: a practical way to prevent mine subsidences, and a subsidence insurance to compensate property owners for damages sustained. The latter proposal to be financed by the State, together with a tax on production. It is believed that a three-man commission should be appointed to study the various problems resulting from surface subsidence due to coal mining.

Research

Much credit is due the Lehigh Navigation Coal Company for their research work during past years; and now a pioneer plant for making a lightweight concrete aggregate from sized breaker slate deserves special mention. The slate, containing 70 percent ash, is clinkered on a traveling grate on which sufficient barley coal is burned to supply the required heat. Their flotation plant for cleaning silt, at present being built, represents a forward step in recovering a coal mining by-product, the cause of stream pollution.

Anthracite Industries, Inc.

Of considerable value to the industry was the work of Anthracite Industries, Inc., organized in 1936 for the purpose of developing a better utilization of anthracite coal and of creating a more favorable public understanding of the industry. Much was accomplished in the following activities: utilization and market research, dealer service, consulting engineering service, public and trade information, freight rates, and legislation. The Primos laboratory of Anthracite Industries, Inc., under the direction of Dr. H. J. Rose, is to be commended for its contribution to research concerning the utilization of anthracite.

Freight Rates

After six years of litigation, the Interstate Commerce Commission rendered an unfavorable decision regarding the application of certain coal producers for a reduction of the freight rate on coal going to tidewater piers in New Jersey for transshipment. The decision, which was close, overruled the recommendation of one of its examiners who suggested a substantial reduction of the rate.

Taxes

Taxing authorities in Luzerne County have been asked by the Lehigh Valley, the Glen Alden, and the Hudson Coal Companies to make a sizeable reduction in coal taxes. The 1943 taxes were paid under protest pending the triennial assessment. Municipalities, and school boards in affected areas were advised by the Taxpayers' Association to segregate 25 percent of their coal tax income for the purpose of refunding it to the coal companies in the event their appeal for a tax reduction is granted.

Safety

The production per fatal accident improved relatively, even though there were 14 men lost in an explosion of gas. Records for a 10-year period are shown in Table 3.

These safety records are based upon a tonnage coming from mines, strippings, refuse banks, and bootleg miners. If they were based upon a production from the mines only, different results would be obtained.

Most mines have a man who devotes his entire time to safety, spending as much time as possible with the miners at the working face.

REVIEW and OUTLOOK for MINING

TABLE 3

PRODUCTION PER FATAL ACCIDENT

Year	Tons
1933	213,395
1934	218,458
1935	192,356
1936	225,162
1937	243,869
1938	207,487
1939	244,761
1940	283,112
1941	285,408
1942	257,509
1943 to October 31	267,109

Mechanical Loading

An indication of the activity in mechanical loading equipment is the following approximate number of installations: eight loaders for mucking in rock tunnels and gangways, 125 shaker conveyor units of which 40 were equipped with self-loading heads, 100 chain conveyors, six mother belt conveyors, and a dozen shortwall cutting machines. Shipments of this class of equipment were retarded because of defense orders in the manufacturer's shops.

Conclusion

There were many industry changes in 1943, but they differed only in degree from those of past years. Important among them was the impact of Federal authority upon management which, no doubt, will be required to adjust itself to the new order. It seems too, that some of the wartime controls will be carried over into the peace period, and the manner in which they function will probably affect the permanency of Federal power in the management of the industry.

An evaluation of developments during 1943 leads to this obvious conclusion: optimal industry service to the nation will result only through intelligent cooperation of management, labor, and Federal authority.

Necessity For Coal Cleaning

A review of 1943 shows that the manpower shortage makes mechanical loading of coal a necessity. Mechanical loading increases the ash and sulphur content, therefore, coal cleaning IS a necessity

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THE YEAR of 1943 showed a decided trend to mechanical loading of bituminous coal and the construction and enlargement of many coal cleaning plants to reduce the increased ash and sulphur, due to mechanical loading.

The bituminous coal industry set a new all-time production record in 1943, by producing 589,000,000 tons of coal (including approximately 3,000,000 tons of lignite), in spite of strikes, work stoppages, labor troubles, absenteeism and loss of nearly 60,000 miners to the armed forces and defense plants.

The coal industry faces an immense task in 1944, to meet the nation's requirements of 625,000,000 tons of bituminous coal, which is the goal set for 1944. It will be necessary to install more and more mechanical loading equipment, to replace the increasing manpower shortage, if the industry is going to meet its requirements.

Mechanical loading of coal increases the ash content at least two (2%) percent, and even more at some mines, because there can be little or no preparation of the coal at the face, when mechanical loaders are used. The sulphur content will also be increased at many mines due to loading of the top and bottom sections of the coal bed, that are often high in sulphur. Formerly, the experienced miner could hand-load clean, low ash and sulphur coals, by means of proper preparation at the face.

During the year of 1943, there was considerable interest in coal cleaning and many coal operators installed new plants or increased the capacity of their washeries, as shown in *Table No. I.*

Many more coal operators are recognizing the need for coal cleaning in order to meet the demand for lower ash and sulphur, as shown by *Table No. II.* There will probably be many more proposed installations in 1944, when the manpower shortage becomes more acute and more mines have to go to mechanical loading, in order to produce the coal required for 1944.

The United States is very fortunate in having several manufacturers of coal cleaning equipment, who are ready to help the coal operator reduce the ash and sulphur in his coal, such as Link-Belt Co., Roberts and Schaefer Co., The McNally Pittsburg Mfg. Co., The Jeffrey Mfg. Co., The Deister Concentrator Co., and a few others. A few pictures of the various types of coal cleaning equipment and recent cleaning plants are shown throughout the paper.

The War Production Board and the Office of Solid Fuels Coordinator, are very much in favor of mechanical loading of bituminous coal and the installation of coal cleaning plants. The coal operator will have no difficulty obtaining the necessary priority for this equipment, particularly if the coal is to be used for producing blast furnace coke for metallurgical purposes.

Value of Low Ash and Sulphur Coal to the Steel Industry

The largest single user of the bituminous coal in this country is the by-product coke industry, which used approximately 110,000,000 tons in 1943. The utility companies used approximately 70,000,000 tons for gas making and the balance of 405,000,000 tons was used by other industries and by the steam and domestic consumers.

The coal operator asks the question, "Just what kind of coal does the coke-oven operator want and why does he require such high-quality coal?" The coke-oven operator's requirements vary with the design of his coke ovens, temperature of car-

Deister Concentrator Co. coal washing tables at Waterman mine, Rochester & Pittsburgh Coal Co.

The author has developed and applied for a U. S. patent on a method for the detection of bands and lenses of pyritic-sulphur in coal seams or lumps of coal, that should be useful to the coal industry. Also, a new method, based on sound engineering principles, for the producing of by-product quality coal from high pyritic-sulphur seams, that cannot be satisfactorily cleaned by present methods.

bonization and the various coals used in the mix charged to the coke ovens. In general, he requires:

1. Uniformity.

2. Low ash—6.5 percent (coke produced from 6.5 percent ash coal will contain from 8.8 to 9.2 percent ash.) (Coal ash×1.35 to 1.40=coke ash.)

3. Low sulphur—under 1.0 percent (but he can use coal with sulphur content up to 1.30 percent, provided it is uniform. The sulphur content of the coke will be 80 to 85 percent of the sulphur in the coal).

4. Carbonization properties should be good, in order to produce uniform, blocky coke of good structure.

5. Expansion properties of the coal, when mixed with other coals charged to the coke ovens, should be neutral or slightly contracting, in order to prevent damage to the brick side walls of the coke ovens.

6. High ash fusion coal is of no advantage when used to produce blast-furnace coke, but is desirable for domestic coke.

In the manufacture of blast-furnace coke in by-product coke ovens, it is necessary to use low ash and sulphur coking coals, in order to produce satisfactory coke that will increase iron and steel production, which is so vital to our war program.

High-ash coke reduces iron production 5 percent for each 1 percent increase in ash content over 9 percent, and requires more coke per ton of iron.

High-sulphur coke requires more limestone and more limestone means more coke and less iron ore burden, which decreases iron production and requires more coke per ton of iron produced.

Coal cleaning will improve coking coals by uniformily reducing the ash and sulphur content, which in turn will improve blast-furnace coke and increase iron and steel production. Also less coking coals will be required to produce a ton of pig iron if the blast-furnace coke is improved by making it uniform in size and structure and uniformly low in ash and sulphur.

REVIEW and OUTLOOK for MINING

Value of Low Ash and Sulphur Coals to the Steam and Domestic User

Mechanical loading makes coal cleaning a necessity for both steam and domestic users. The reduction in ash by cleaning will improve the calorific or heat value, thereby increasing boiler or heating efficiency and at the same time saves freight on excessive ash, which is an inert material, saves on ash disposal, and coal will be more uniform in size and quality.

The reduction in ash at some mines will increase the ash fusion temperature, but at the other mines lowering the ash content decreases the ash fusion temperature, due to the re-

TABLE NO. I.

Coal Cleaning Plants Erected or Capacity Increased During 1943

Operator	*Mine*	*Location*	*Seam*
1. Alabama By-Products Co.	Praco	Praco, Ala.	Mary Lee
2. Alabama Power Co.		High Level, Ala.	American & Pratt
3. Butler Consolidated Coal Co.	Wildwood	Wildwood, Pa.	Thick Freeport
4. Dering Coal Co.	Derco No. 2	Eldorado, Ill.	Illinois No. 5
5. Leo Duncan	(for beehive coke ovens)	Uniontown, Pa.	Pittsburgh
6. Eastern Gas & Fuel Div., The Koppers Coal Co.	Kopperston No. 1 & 2	Kopperston, W. Va.	Eagle & No. 2 Gas
7. Guyan Eagle Coal Co.	Guyan Eagle No. 1 & 3	Amherstdale, W. Va.	Chilton & Island Creek
8. Huntsville Sinclair Coal Co.	Mark Twain	Huntsville, Mo.	Bevier
9. J. C. Jamison Co.	Etna	Bradley, W. Va.	Pittsburgh
10. Jamison Coal Co.	Jamison No. 9	Farmington, W. Va.	Pittsburgh
11. Koppers Coal Co.	Sonman Shaft	Sonman, Pa.	Lower Kittanning
12. McAlester Fuel Co.	Carbon	Carbon, Okla.	McAlester
13. McAlester Fuel Co.	McCurtain	McCurtain, Okla.	Lower Hartshorne
14. Montana Coal & Iron Co.	Smith	Bear Creek, Mont.	Fort Union
15. New River Co.	Summerlee	Summerlee, W. Va.	Sewell
16. New River Co.	Lochgelly	Lochgelly, W. Va.	Sewell
17. Old Ben Coal Co.	Old Ben No. 8	West Frankfort, Ill.	Illinois No. 6
18. Pyramid Coal Co.	Victory	Seeleyville, Ind.	Indiana No. 4
19. Republic Steel Co.	Clyde	Fredericktown, Pa.	Pittsburgh
20. Republic Steel Co.	Republic	Pikesville, Ky.	Elkhorn No. 2 & 3
21. Rochester & Pittsburgh Coal Co.	Kent	McIntyre, Pa.	Lower & Upper Freeport
22. Semet Solvay Co.	Harewood	Lonacre, W. Va.	Eagle
23. Sloss Sheffield Steel & Iron Co.	Flat Top	Flat Top, Ala.	Mary Lee
24. Tenn. Coal, Iron & R. R. Co.	Short Creek	Birmingham, Ala.	Pratt
25. West Penn Power Co.	Windsor	Power, W. Va.	Pittsburgh
26. Utah Fuel Co. & Kaiser Co.	Sunnyside	Sunnyside, Utah	Lower Sunnyside

TABLE NO. II.

Proposed Coal Cleaning Plants for 1944

Operator	*Mine*	*Location*	*Seam*
1. Algoma Coal & Coke Co.	Piney & Pinnacle	Algoma, W. Va.	Poca. No. 3 & 4
2. Cane Creek Coal Co.	Cane Creek	Bankhead, Ala.	Mary Lee
3. Columbia Steel Co.	Horse Canyon	Horse Canyon, Utah	Lower Sunnyside
4. The Ford Coal Co.		Beallsville, Pa.	Pittsburgh
5. H. C. Frick Coke Co.	Robena	Robena, Pa.	Pittsburgh
6. H. E. Harmon Coal Co.	Harman	Harman, Va.	Bull Creek
7. Jones & Laughlin Steel Co.	Shannopin	Bobtown, Pa.	Pittsburgh
8. Midvale Coal Co.	Midvale No. 4	Midvale, Ohio	Ohio No. 6
9. Monroe Coal Mining Co.	Revloc	Revloc, Pa.	Lower Kittanning
10. North American Coal Co.	Mead No. 2 & 3	East Gulf, W. Va.	Poca. No. 3 & 4
11. Peerless Coal & Coke Co.	Peerless	Vivian, W. Va.	Poca. No. 3 & 4
12. Raleigh Wyoming Coal Co.	Edwight	Edwight, W. Va.	No. 2 Gas
13. Republic Steel Co.	Virginia	Virginia, Ala.	American
14. U. S. Coal & Coke Co.	(several mines)	Gary, W. Va.	Poca. No. 3 & 4

Cleaning plant at Clyde mine, Republic Steel Corp., built by Roberts & Schaefer Co.

moval of certain mineral matter. Ash in coal is composed chiefly of SiO_2, Al_2O_3, Fe_2O_3, and CaO and MgO. The higher the ratio of Al_2O_3 to SiO_2, the higher the ash fusion. On the other hand, the higher the percentage of alkalies, alkaline earths, and iron oxide, the lower the ash fusion temperature. The ash fusion of washed coal from some mines may be lower in sizes, due to the reduction of calcite, which is released by crushing and washed out in the coal-cleaning plant. For example, a sample of coal containing 11.5 percent ash had a 2,600° F. ash fusion, but when crushed and washed the ash was reduced to 5.3 percent and ash fusion reduced to 2,210° F.

The reduction in the sulphur content reduces trouble from clinkering and slagging and reduces corrosion and rapid deterioration of all metallic parts by the action of sulphur dioxide in moist air, which forms sulphurous acid. High-sulphur coals also corrode coal-handling equipment, bins and bunkers, due to the oxidation of pyrite sulphur to sulphate sulphur and then to sulphuric acid.

Coal Cleaning is a Science

Coal cleaning is a science, because coal varies in different seams, districts, and even in the same mine. The coal operator, with his production, labor and maintenance problems, does not have sufficient time to make a thorough study of the coal from his mine. The design of each coal-cleaning plant must be different for each mine and a float and sink study of the coal is not sufficient information with which to design a cleaning plant. A study should be made of the mineral matter associated with the coal in the mine, the forms and distribution of sulphur, and how geology has affected the ash and sulphur content, as well as the expansion and carbonization properties.

Mineral Matter Associated With Coal

There are two kinds of mineral matter associated with coal: inherent and extraneous. *Inherent* mineral matter is defined as that portion of mineral matter originally combined with the coal, such as iron, phosphorus, sulphur, calcium, potassium and magnesium, which has been assimilated by the living plant. The quantity of inherent mineral matter in coal is only from 1 to 2 percent. All other ash is extraneous matter.

Extraneous mineral matter in coals is the part that is foreign to the plant material contributing to the formation of the coal. It may represent mineral matter deposited during the formation of the peat or those deposited in the cleavage and fracture cracks after the peat has been consolidated. The extraneous mineral matter includes particles, microscopic in size, to thick partings of shale and sandstone.

Mechanical loading of coal increases the extraneous mineral matter considerably, due to pieces of roof, bottom, bone coal and shale, slate or sandstone partings, that the hand-loading miner would pick out with proper preparation of the coal at the face. Let us consider some of the more important impurities found with coal.

Clay is the most common impurity in coal, and we find clays are usually mixtures of several minerals, among which kaolin minerals, quartz, a sericite-like mineral and pyrite are common, with several other minerals found in high ash, bone coals, and shale partings.

The mineral kaolinite ($H_4Al_2Si_2O_9$) should not be confused with the rock kaolin, because kaolinite occurs not only in kaolin deposits but also in some clay and shales, and a large part of the kaolinite in coal was deposited during the peat stage of coal formation. Kaolinite was carried into the peat bog by streams draining into the swamp and evidence leads to the conclusion that most of it was deposited in solution. A second type of kaolinite that occurs in the cleats and joints and in the attritius of the coal evidently was carried in solution by percolating waters and deposited following the peat stage of coal formation and is found associated with calcite and pyrite in cracks in coal seams. Kaolinite is the common mineral in high-ash bone coals and some clay and shale partings.

Pyrite and *Marcasite* are iron disulphides ($Fe S_2$) and are both found in coal. Pyrite is brass-yellow and is the cubic form as compared with marcasite, which is grayer and is the orthorhombic form. Pyrite is less susceptible to weathering than marcasite and is harder and has a higher specific gravity. Pyrite occurs as lenses, bands, balls or modules, veins, pyritized fossils and finely disseminated particles. These lenses vary in size from bands or streaks of ½ in. to 3 in. in thickness and a foot across, to 3 to 4 ft. in thickness and several hundred feet long, often found in the top and bottom of the seam. Balls are round or irregularly angular masses of pyrite and consist of mixture of pyrite, clay, siderite, calcite, and dolomite. It occurs regularly throughout the coal or concentrated in certain benches or bands of the coal bed. Marcasite is the form of pyrite found in the joints and cleats

of the coal and is of secondary origin, being deposited from percolating waters after the coal was compacted and consists of mixtures of kaolinite and calcite. These thin films give the appearance of much more sulphur than is actually the case.

Finely disseminated pyrite makes up a large portion of the pyrite in coal. They may consist of separate particles or groups of particles that are actually grown together. The finely disseminated pyrite may be distributed evenly throughout the bed, but more often it is concentrated in benches or layers. The origin of pyritic sulphur is covered later in the paper, under sulphur forms in coal.

Calcite ($Ca\ CO_3$) in coal is often contaminated with ferrous carbonate or may grade into ankerite, a mineral containing carbonate of calcium, magnesium and iron, and a small amount of manganese and most of the calcite in coal was deposited in the coal after its formation by percolating waters, and is usually found in the joints and cleats, but is also found in clay or shale partings of the coal.

Quartz (SiO_2) is entirely or almost entirely absent in many coals, but it is the predominant mineral constituent in a few beds. It occurs especially in high-ash coals and bony coals and in coals with sandstone floor and sandstone partings. Quartz in coal was deposited mechanically during the peat stage and originated from solution or collodial suspension. It occurs largely in the attrital debris.

Siderite ($Fe\ CO_3$) is a common mineral constituent of some coals. It is characterized nearly always by a brown stain of limonite on the surface and it may contain large proportions of manganese and calcium carbonates. It is believed that ferrous carbonate usually is formed from solutions of ferrous bicarbonate through loss of carbon dioxide. Siderite changes to brownish-black limonite upon exposure and with further loss of water it may change to hematite, known as "black band," when in form of lenses or bands in coals. High ash or bony coal usually contains a much greater variety of minerals than low or medium ash coals. Sometimes muscovite is found in the high-ash coals, immediately below the shale partings of the coal bed.

Limonite ($2\ Fe_2O_3.3\ H_2O$) occurs along with films of clay on the surface of lump coals, particularly from strip or outcrop coal, and accounts for the brownish color of strip coal.

Rock Impurities

Clay is defined as an earth or stony material aggregate consisting essentially of hydrous silicates of alumina, and it is plastic when pulverized or wetted, rigid when dry, and vitreous when fired at sufficiently high temperatures. Clays include kaolin, shales, under-clays and glacial clays. There has been much confusion on the terms "clay," "shale" and "slate" because they have virtually the same composition but differ in the degree of compactness.

Shale is compacted clay that has been hardened by pressure and has more or less thinly laminated or fissile structure. Many of the fire clays associated with the coal beds should be designated as shales.

Slate is rock produced through the compression of clay or shale. Most clays originate from rocks and soils rich in feldspars. The clay in coal was deposited by streams that drained into the peat swamps from surrounding lands. Whenever the drainage was feeble, only material in solution and the finest muds in suspension were carried into peat bogs, which accounts for the low-ash coals, but as the muddiness increased in the water drained into the swamps, more clays are deposited, with the result of high-ash and bone coal, and finally clays and shales were deposited.

Clay and shale partings are the most common impurity found in coal.

Jeffrey Baum jig-washer

REVIEW and OUTLOOK for MINING

When coal is loaded mechanically, without face preparation, we find not only the clay or shale partings but clay, shale, slate or sandstone from the roof or bottom contaminating the coal.

In the Pittsburgh seam we find two partings over almost the entire bed, which are about ⅜ in. thick and 3 to 5 in. apart and occur approximately 30 in. from the bottom of the coal bed. These uniform partings were formed by extensive flooding of level swamp surfaces, when the mineral matter was deposited quickly, without interrupting the growth of the swamp plants, while the irregular partings were deposited on an uneven swamp surface. The partings often contain streaks and bands of coal material and kaolinite is sometimes present in the partings, as well as mica-like material termed "hydromica," which is a common mineral found in many clay and shale partings.

Sandstone partings are very rare in coal, although sandy shales are quite common. Sandstone occurs in thick partings where the coal bed is split and was probably caused by washouts and associated phenomena.

Distribution of Mineral Matter in Coal

In some coals the amount and distribution of mineral matter is uniform from top to bottom of the bed, and in such coals the ash content may be low, medium, or high. Coals of this sort are hard to improve by selective mining or coal cleaning. In most coals the ash is highly concentrated in certain parts of the bed. The mineral matter of each coal is a specific problem and one can make no generalization.

The mineral matter in *low-ash coals* consists chiefly of kaolinite, whereas the mineral matter found in high-ash or bone coals has a dull luster and consists of particles and lenses of clay embedded in the coal. High-ash or bone coals have a higher specific gravity than low- or medium-ash coals.

Forms of Sulphur in Coal and Their Origin

There are three forms of sulphur found in coal: organic, pyritic, and sulphate sulphur.

Organic sulphur found in coal is a carbon-sulphur complex, which was derived from the vegetable matter of plants, from which the coal was

Link-Belt cleaning plant of Praco mine, Alabama By-Products Corp.

formed. Dr. R. Thiessen, Dachnowski and other coal botanists have shown that the sulphur in peat bogs ranges from 0.21 to 4.57 percent. Sulphur is found in plants in two forms: as a component of protein and non-protein sulphur. Organic sulphur in the coal can *not* be reduced by present methods of coal cleaning.

Pyritic sulphur found in coal is iron disulphide (FeS_2), which was produced in the peat bog by the action of certain iron-depositing, anaerobic bacteria or microorganisms. According to studies by Winogradsky, Harder, Thiessen and others, there are several known species of iron-depositing bacteria, the best known is the "Beggeatoa" specie.

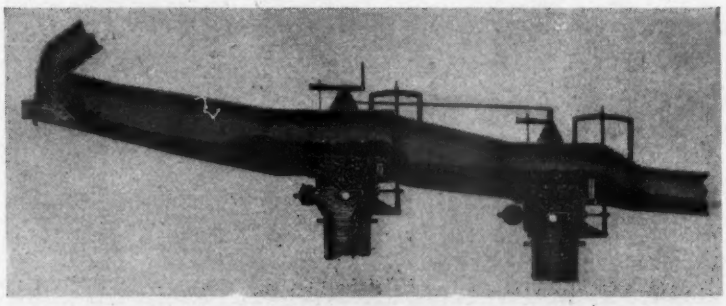
Pyrite is generally found in the dull or attrital portion of coal, because bacteria thrive on the decaying vegetable matter, which gave off hydrogen sulphide, necessary to the growth of the bacteria. These bacteria obtained their food (carbon) from the decaying vegetable matter and their oxygen from sulphates contained in the swamp waters. Ferric sulphate ($Fe_2(SO_4)_3 \cdot 9\ H_2O$) is more soluble in water than most metallic sulphates and probably was present in appreciable quantities in the water drained into some peat bogs. The bacteria reduced the iron sulphate, by removing the oxygen, to iron disulphide, which is practically insoluble in water. Some other sulphides are also found in pyrite, but most of these sulphides are more soluble in water than iron disulphide, or decompose rapidly and were washed out by the percolating waters.

All pyrite in coal was formed in the peat bogs before the peat was consolidated, and the formation of pyrite was stopped when the oxygen supply for the iron-depositing bacteria was cut off. This occurred when large quantities of silt and sand were washed into the swamps and prevented the water containing iron or other sulphates from percolating through the peat.

In general, throughout Pennsylvania, West Virginia, and Ohio a sandstone roof on top of the coal indicates high pyritic sulphur coals. Let us consider the Pittsburgh seam, which varies in pyritic sulphur content in different sections of the seam. Approximately 14 in. above the Pittsburgh bed we find a rider-seam of coal. The rock between the main and rider-seam is either shale, slate, draw slate or sandstone. This layer of rock was formed by a geological sinking of the peat bog, causing a rush of silt and sand-filled waters into the swamp, disturbing the growth of the peat bog. The silt was consolidated into clays and shale, which prevented the percolating waters from reaching the iron-depositing bacteria, therefore the formation of the iron disulphide was stopped. However, in the section of the swamp where the sand had settled out the percolating waters continued to supply sulphate to the bacteria in the decayed vegetable matter, while the Pittsburgh rider-seam was being laid down, which resulted in a greater quantity of pyrite being formed.

There are exceptions to the fact that high pyritic sulphur occurs under a sandstone roof, probably because the percolating waters from the swamps did not contain sufficient sulphates for the growth of the bacteria. In Kentucky, we find low sulphur coals directly under a sandstone roof and find these coals to be splint or semi-splint, which are composed of a large percentage of attrital matter. This lack of pyrite is probably due to the fact that either the bacteria causing the decomposition of the vegetable matter were not of the iron-depositing species or there was not sufficient iron sulphate in the percolating waters from the swamp for the rapid growth of iron-depositing bacteria. The writer believes that the type of bacteria was different, which caused a more rapid decomposition of the vegetable matter. This reason is given because of the high percentage of dull coal or attirtus in these Kentucky coals and the low pyritic sulphur content.

Sulphate sulphur is found in very small quantities in freshly mined coking coals and any large percentage (over 0.005 percent) is due to the oxidation of the pyrite or marcasite, which oxidize very rapidly in the moist air. A high percentage of



Flow diagram of McNally-Pittsburg rheolaveur coarse coal launder

TABLE III.

Sulphur Distribution in Various Coal Seams

Seam	*Section*	*Av. % Organic*	*% Pyritic*
Pittsburgh	Fairmont, W. Va. (Low Sulphur Section)	.65 (.54 to .75)	.20 to .50
Pittsburgh	Fairmont, W. Va. (High Sulphur Coals)	.95 (.68 to 1.50)	.20 to 4.00
Pittsburgh	Fayette Co., Pa.	.72	.20 to .80
Pittsburgh	Washington Co., Pa.	.75	.20 to .80
Pittsburgh	Westmoreland Co., Pa.	.77	.20 to 1.00
Pittsburgh	Allegheny Co., Pa.	.65	.25 to 2.00
Pittsburgh	Greene Co., Pa.	.95	.20 to 4.00
Pocahontas No. 3	McDowell Co., W. Va.	.53	.00 to .30
Pocahontas No. 4	McDowell Co., W. Va. Tazewell Co., Va.	.57	.05 to .35
Pocahontas No. 5	McDowell Co., W. Va.	.65	.00 to .30
Pocahontas No. 6	McDowell Co., W. Va.	.51	.00 to .30
Jewell	Tazewell Co., Va.	.50	.10 to .30
Beckley	Raleigh & Fayette Co., W. Va.	.55	.05 to .30
Sewell	Fayette Co., Pa.	.60	.10 to .50
Eagle	Logan Co., W. Va.	.61	.05 to .30
No. 2 Gas	Kanawha Co., W. Va.	.63	.05 to .30
Powellton	Fayette Co., W. Va.	.63	.05 to .30
Cedar Grove	Logan Co., W. Va.	.55	.10 to .40
Fire Creek	Fayette Co., W. Va.	.53	.10 to .40
Lower Freeport	Indiana Co., Pa.	.56	.20 to 1.20
Upper Freeport	Indiana Co., Pa. Preston Co., W. Va.	.57	.20 to 1.00
Lower Kittanning	Cambria Co., Pa.	.65	.40 to 4.00
Lower Kittanning	Indiana Co., Pa.	.66	.60 to 2.00
Lower Kittanning	Clearfield Co., Pa.	1.50	1.00 to 1.50
Lower Kittanning	Elk Co., Pa.	1.08	1.00 to 2.00
Lower Kittanning	Armstrong Co., Pa.	1.34	1.50 to 3.00
Lower Kittanning	Clarion Co., Pa.	1.40	1.50 to 3.00
Lower Kittanning	Jefferson Co., Pa.	.90	.60 to 1.00
Upper Kittanning	Cambria Co., Pa.	.65	.60 to 3.00
Pond Creek	Pike Co., Ky.	.61	.10 to .70
Hignite	Letcher Co., Ky.	.50	.10 to .40
High Splint	Harlan Co., Ky.	.52	.10 to .40

sulphate sulphur is found in strip, outcrop, pillared, or stored coal, due to the rapid oxidation of pyritic sulphur. Washing of high-sulphate coals will remove the sulphate sulphur, but may make the washer water acid, causing poor reduction of ash and sulphur in the washer.

Table No. III shows the average distribution of organic and pyritic sulphur in several different coal seams.

Blending and Cleaning Coking Coals

The main requirements for good coking coals are uniformity, uniformity of expansion and carbonization properties, and uniformly low ash and sulphur.

The major problem in the production of iron and steel is raw materials, which will become poorer in quality as time goes on. The high-quality iron ore will be worked out within 10 years and it will be necessary to use high silica and low iron content ores and perhaps even higher sulphur ores. In the coal industry we find the shortage of manpower a serious factor, therefore the necessity to install mechanical loading equipment, which means coal-cleaning plants to reduce the higher ash and sulphur. Many of the coal seams producing high-quality coking coals are being worked out and we have to use coal from other seams, which are not being used as coking coals at the present time.

Let us consider the beneficiation of coals from some of the better known seams:

Pocahontas No. 3—This seam only covers a small area and has been so extensively mined that our reserves of this coal are small. This coal varies considerably in expansion properties, due to geology, as shown in the author's paper "Plan to Improve Blast Furnace Coke," presented at the A. I. M. E. and A. S. M. E. Fuels Conference in September, 1942, at St. Louis.

The sulphur content of this coal is uniformly low, but the ash content is greatly increased by mechanical loading; however, the ash may be readily reduced by coal cleaning. The writer suggests that coal from No. 3 Pocahontas seam be thoroughly blended, either underground or on the surface, when the coal from two or more mines is to be washed together, in order to insure a uniform expansion, which will prevent damage to the coke ovens and produce a more uniform coke.

Pocahontas Nos. 4, 5, and 6—Coal from these other Pocahontas seams are low in sulphur but vary considerably in expansion and carbonization properties. The excessive ash due to mechanical loading can be readily reduced by cleaning. However, the writer suggests that coal from these seams be carefully blended, particularly if they are to be mixed with coal from No. 3 Pocahontas seam, in order to insure uniform expansion and carbonization properties.

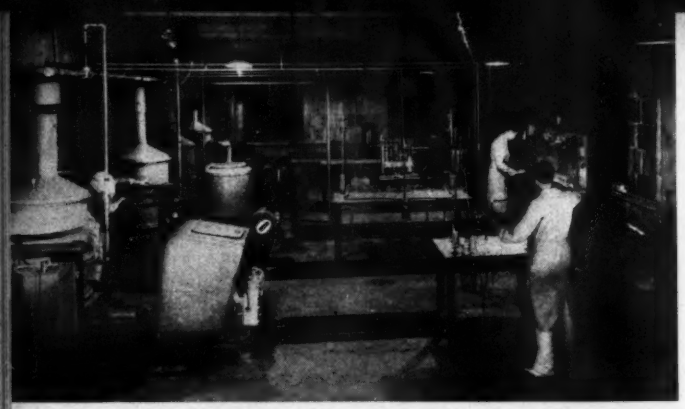
Sewell and Beckley—The coal from these seams is fairly uniform in sulphur and the ash can be reduced by cleaning, but again there is a great variation in the expansion and carbonization properties and much thought should be given to blending before washing and at the coke plant, in order to produce a satisfactory blast-furnace coke.

Pittsburgh—The good quality coking coal in the Pittsburgh seam is fast becoming exhausted and it is necessary to use high-sulphur coals from Greene County and Fairmont, W. Va., districts.

The expansion properties are fairly uniform in the high-sulphur districts and they have good carbonizing properties. The ash due to mechanical loading can be readily reduced by cleaning, but the sulphur, which is largely pyritic, is disseminated through the coal bed, making it very difficult to reduce to by-product coking quality.

Lower and Upper Kittanning—The coal from these two seams varies considerably in sulphur content. The coal from Somerset, Cambria, and Indiana Counties in Pennsylvania are fairly uniform in organic sulphur, but the coal from Armstrong, Elk, Clearfield, and Clarion show a high organic sulphur.

The coal from Somerset, Cambria, and Indiana Counties is high in pyritic sulphur, which can be satisfactorily cleaned by the new method.



ection of coals for stokers and adaptation of stokers for various coals are studied in this laboratory

Bituminous Coal and Research

Highlights of the research program of Bituminous Coal Research, Inc., during the past three years, which is now to be greatly expanded.

By HOWARD N. EAVENSON
President
Bituminous Coal Research, Inc.

MOST of the readers of this magazine know that the bituminous coal industry organized a research agency in 1934, called Bituminous Coal Research, Inc. Its first financing was by the sale of stock and was on a very limited scale, and the money was exhausted by 1937. After several years of quiescence, contributions were obtained from a number of coal producers and coal-carrying railroads and in 1940 work was renewed on a larger, but still small, scale. Now the work is at the rate of slightly over $100,000 per year.

During the last three years work has been done on the following projects.

Dustless Treatment

Meeting the emergency caused by the Limitation Order of the War Production Board forbidding the use of oil for the treatment of coal, we published in May, 1942, Information Bulletin No. 4, giving all the information on the use of substitute materials available at that time. Since then we have actively investigated other materials and, in cooperation with the Calcium Chloride Association, which has borne more than half the cost of the work, we have obtained data not previously available on the relation of the amount of calcium chloride applied to coal to the dustiness of coal and on the permanence of the treatment. This information has been widely disseminated to the industry through our Information Bulletin No. 5. We recognize the problem of the corrosion of iron and steel in contact with calcium chloride, and we have established one possible mechanism of the attack on stoker screws that has caused more or less difficulty in the past. We are working on methods of prevention of this type of attack.

We are also investigating all other possible materials, including vegetable oil, waste paper-mill liquors, and coal-tar products. We are glad to state that quite recently we have obtained information which indicates that a particular fraction of coal tar may be quite suitable for the dustless treatment of coal. If this develops as we hope, we will have for this purpose a material produced from bituminous coal. Since the use of heavy oils has been authorized for dustproofing, we are studying the qualities and odor of these oils and hope to issue some information about them in the near future.

The Development of Smokeless Stoves

With the cooperation of a group of 27 of the leading manufacturers of coal-burning stoves, we have developed a principle of combustion that can be applied to stoves, furnaces, and water heaters that gives essentially smokeless combustion of both high- and low-volatile coals. A number of models of this stove have been built in different sizes, and we are now obtaining data on the critical dimensions from which the manufacturers may be able to design and build heaters for various rates of burning and of heat output.

The cooperating manufacturers are now engaged in developing their own models incorporating this principle. One manufacturer has already submitted a model to Battelle for test, and two others will shortly have models ready to submit. Others will follow, and it is confidently expected that after the war, or perhaps before if materials are available, these stoves will be offered on the market.

A number of these stoves, made by one manufacturer, are being tested this winter in various localities and with various coals. These units are not the final ones to be marketed, but the smoke performance is very satisfactory.

Automatic Residential Heating

Recognizing the demand of the public and the need for automatic heating of residences, Bituminous Coal Research, Inc., has continued to devote attention to residential stokers. Particularly it has been interested in the development of stokers that will handle a wide range of bituminous coal, both high and low volatile, both strongly coking and free burning, and with both high and with low ash fusion temperatures. A rotary-grate stoker of novel design has been built and tested with a variety of coals. Although not all of the problems encountered have yet been solved, progress is being made and it is expected that this will be developed to the point where it can be turned over to manufacturers for marketing in the post-war period.

Battelle Memorial Institute, during the time when Bituminous Coal Research had no funds to continue its work, developed a residential stoker at its own expense, which is now

under development by a large manufacturer.

Another stoker adapted primarily for the strongly coking eastern coals has been developed at Pennsylvania State College and will be on the market as soon as war conditions permit.

Year-Round Air Conditioning

Summer cooling of residences had made considerable strides before the war, and it is expected that it will continue to do so after the war. This field has been almost exclusively a market for gas and electric power, although it appears possible that the low-cost fuel, bituminous coal, should have a definite place in the picture. Exploratory studies are now under way to develop the possibilities of the application of coal to summer cooling and air filtering, and experimental research will be started when the most promising path is apparent. A summer market for coal in residences would obviously provide a better load factor not only for the industry but also for the railroads and the retailer, and be a blessing for Mrs. John Q. Public.

Utilization of Coal in the Process Industries

Of the many metallurgical and ceramic industries where coal has lost markets to competitive fuels, the first field chosen for attack was that of application to forging furnaces. Experimental research has demonstrated that pulverized coal, both high and low volatile, can be successfully applied to the smallest as well as the largest forge furnaces. Savings of large amounts of fuel oil now used in these forge furnaces are possible by conversion from oil to coal.

Further work in the development and use of these pulverized-coal-using furnaces is beyond the stage of research and must be done by some organization other than Bituminous Coal Research.

We have also demonstrated that pulverized coal can be successfully burned in alloy steel radiant tubes, which are widely used for heat-treating and annealing furnaces. Because the products of combustion remain inside the tube and do not come in contact with the work to be heated, controlled atmospheres around the ware are possible. One of the great advantages of the fluid fuels, gas and oil, as compared with pulverized coal is the convenient method of distribution in pipes whereby the fuel is ever ready at the turn of a valve. Work has recently been started on the fundamentals of distribution of pulverized coal in suspension in air to provide information for the design of distribution systems that will give pulverized coal advantages similar to those of competitive fuels.

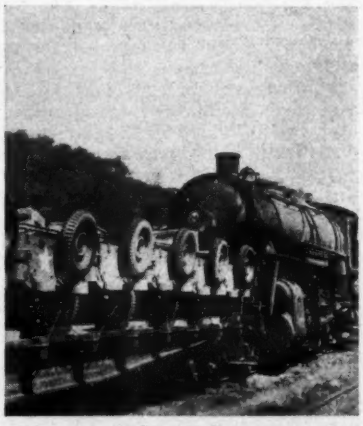
Overfire Air Jets

Jets for the introduction of air above the fuel bed by means of steam or motor-driven fans have long been used to improve combustion and to eliminate smoke. Data for their design have heretofore been lacking and their installation has had to be by rule of thumb. We have recently obtained the required data and thus have placed the design of these jets on a rational basis. Engineering papers presented at recent meetings of the American Society of Mechanical Engineers and the Smoke Prevention Association have been highly acclaimed as important contributions to the art of burning coal. There is a promising field for these jets in both locomotives and stationary power plants, where the efficiency of burning can be increased and the smoke produced be largely reduced.

Railroad Locomotives

To encourage the development of improved coal-fired steam locomotives that may serve to ward off the increasing encroachment of the Diesel

Smoking locomotive with steam-air jets turned off



Five seconds later with steam-air jets turned on. Smoke-forming gases are burned completely

REVIEW and OUTLOOK for MINING

locomotive in this most important market for bituminous coal, Bituminous Coal Research, Inc., has for the first time brought together engineers of the coal industry with engineers of several of the leading railroads and of all the locomotive builders in two important conferences. At the request of the engineers of the railroad and locomotive industry, our committee of engineers prepared an analysis of the method of utilization of coal in steam locomotives. This analysis shows that by the adoption of high-pressure water-tube boilers properly designed for pulverized coal, the economy of coal can be so increased with retention of the reliability of the steam locomotive that the threat of the Diesel should be definitely overcome. These conferences will be continued with the expectation that they will lead to concrete accomplishments.

Study is also being made of the possibility of using other types of prime movers on locomotives.

Power from Coal

The direct production of power from coal in an internal-combustion engine, long the dream of engineers, has been defeated by the wear of the coal and ash on the metal cylinders and pistons. An analysis of the Humphrey pump, an internal-combustion engine using a water piston, showed that it should be well adapted to the use of pulverized coal without the difficulty of cylinder and piston wear. Unfortunately, this type of engine must be built and proved in full-scale rather than laboratory models. Although we had full cooperation from one of the large manufacturers of pulverized-coal equipment, we have been unable to obtain a suitable location for the installation and trial of one of these pumps as an auxiliary at a hydro-electric plant. Consideration is also being given to the use of the coal-fired pump for other purposes.

A study is also started to see if pulverized coal can be used in gas turbine sets.

Gasification of Coal

Following up the results of a survey made four years ago which showed that the principal need of the manufactured-gas industry was a process of gasification of coal that produced no by-products such as coke for which it was necessary to provide a market in proportion to the demand for gas, experimental research has

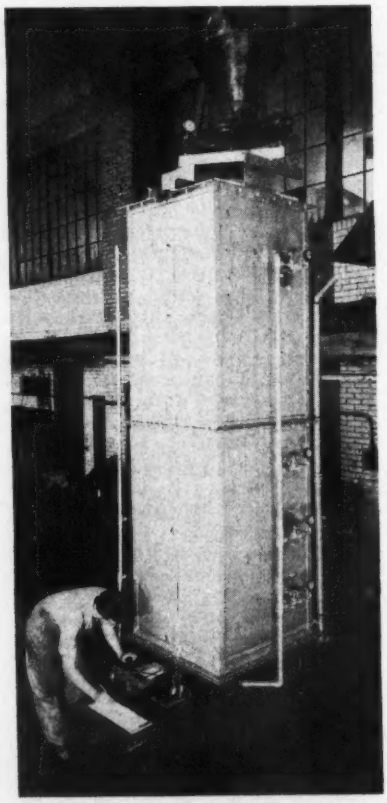
recently been started to develop such a method of gasification. Although the expected product of the process will be a relatively low B. T. U. gas, it can be converted to a gas of high calorific value suitable for city distribution and will also serve as a starting point for the synthesis of chemicals. It is expected that the process will not only provide a low-cost gas but will be suitable for use with a wide range of bituminous coals, whereas present processes of gasification are suited principally to a relatively few premium coals.

Mining Problems

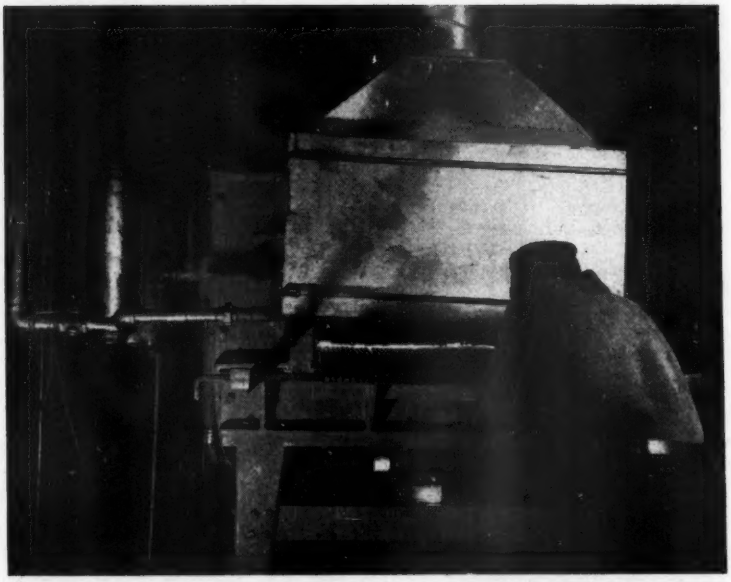
Work has been started at the University of West Virginia on two mining problems, one dealing with the reduction of acid mine water and methods of purifying it before discharge into streams, and the other with the possible effects of sulphur and other chemicals in causing falls of mine roofs and methods of preventing them.

We have demonstrated that it is possible to pick refuse from large pieces of coal by X-ray and electronic means, and intend to develop this idea to find commercial application, if the application is an economic one.

None of the work done on any of these projects duplicates that being done elsewhere.



The complete gasification of coal is the goal of this tower-like apparatus



As final proof of the suitability of pulverized coal for firing forge furnaces, a production run was made in a forging shop

To keep subscribers and the others in touch with the progress of research on coal, a small paper, *Bituminous Coal Research*, has been published four times a year. This has given brief stories of the results of our own work, as well as that done elsewhere in the world.

Information and Service

A large amount of correspondence with producers, equipment manufacturers, and users of coal is continuously carried on to answer a wide variety of specific questions relating to better preparation or utilization of bituminous coal.

An active part has been taken in the formulation of standards for the testing and rating of domestic heating appliances using coal. The program has reached the point where facilities should be provided for extending the rating test service to manufacturers as is done by the American Standards Association and Anthracite Industries in their respective fields, and this will be done as soon as possible.

Fundamental Work

At the Carnegie Institute of Technology, in spite of serious loss of staff to Government service and war industries, the Coal Research Laboratory is continuing experimental investigations on combustion of powdered coal, hydrogenation and oxidation studies of coal constitution, reactivity of coal and coke, and analyses of published data. In addition, the Coal Research Laboratory is supervising the work of a group of investigators who are studying methods of possible commercial interest for production of organic acids from coal, which should be of value to both the plastic and synthetic rubber industries. When additional staff can be obtained it is planned to undertake a thorough investigation of heat transfer into a charge of coal being coked, to build a small continuous hydrogenation plant for studying the production of chemicals from coal by hydrogenation, and to make a thorough study of the factors which control the physical quality of coke.

The coal industry *per se* has taken only a very small part in providing funds to support the Coal Research Laboratory.

Development Work

There are several projects which have reached a stage where research work has ended and commercial development should begin. This is not the function of Bituminous Coal Research, and the industry should provide some organization to push the development of these improvements.

Future Program

The present program of research is the largest that has ever been supported in this country by the bituminous coal industry and has had wider support than any previous program. About 350 producers have been subscribing at the rate of one-third mill per ton of annual shipments, and four railroad companies have been subscribing at the rate of one-sixth mill, or more, per dollar of coal freight revenue. Five other producers and one railroad have been

(*Continued on page* 91)

Sales of Mechanical Loading and Cleaning Equipment For Coal Mines In 1943

Wartime restrictions on materials reflected in continued downward trend in sales of new equipment. However, percentage of bituminous coal mechanically loaded and cleaned increases.

By W. H. YOUNG
R. L. ANDERSON
G. A. LAMB
J. W. BUCH*

SALES of underground mechanical-loading equipment for use in bituminous coal, anthracite and lignite mines in the United States decreased in 1943 from 1942. In terms of capacity the 1943 sales were 32 percent less than 1942.

Capacity of mechanical-cleaning equipment installed at bitumious mines was 45 percent less in 1943 than in 1942.

This survey was made possible by the courteous cooperation of all known manufacturers of mechanical loading and cleaning equipment in the United States, supplemented with data from various trade journals.

Preliminary estimates show that mechanical loading of underground bituminous coal and lignite increased from 36.3 percent of the total output in 1941 to 39.6 percent in 1942 and 42.4 percent in 1943. Bituminous coal mechanically cleaned increased from 22.8 percent of the total output in 1941 to 24.5 and 25.5 percent in 1942 and 1943, respectively. There are no mechanical-cleaning plants at lignite mines. Underground mechanical loading in Pennsylvania anthracite mines increased from 23.8 percent of the total output in 1941 to 24.5 percent in 1942 and decreased in 1943 to 23.9 percent of the total.

Table 1 shows bituminous coal and lignite production by methods of mining and the total output of mechanically cleaned coal for the years 1941-43, inclusive. Pennsylvania anthracite production by methods of mining is shown in Table 2.

Mechanical Loading of Bituminous Coal, Anthracite, and Lignite

Total units sold by type. Table 3 shows the units of mechanized loading equipment sold for use in underground bituminous coal, anthracite, and lignite mines, as reported by manufacturers for the years 1936-43, inclusive.

Sales of all types of mechanical-loading equipment showed a decrease in 1943 from the previous year.

Mobile-loader sales decreased from 352 in 1942 to 234 in 1943, or 33.5 percent. During the past eight years, this low figure was reached in only one year, namely 1940, when 233 units were sold.

Sales of scrapers decreased from 29 in 1942 to 15 in 1943, or 48.3 percent.

Conveyor sales also registered a decrease in 1943 from 1942, but it was a smaller percentage loss than any of the other types of loading equipment. Sales of conveyors decreased from 1,491 in 1942 to 1,100 in 1943, or 26.2 percent.

Only one pit-car loader was sold during 1943.

Regional distribution of sales.—The total number of units of mechanical-loading equipment of all types sold in the various States and regions in 1943 is shown in Table 4. Types of equipment sold in approximate order of capacity are shown by letter symbol. For example, 127 mechanical-loading units of equipment were sold in Pennsylvania. In this total of units sold, mobile loaders (indicated by "L") furnished the largest addition to capacity and conveyors ("C") furnished the second largest addition, followed by scrapers ("S"). Capacities are based on actual performance

TABLE 1.—BITUMINOUS COAL AND LIGNITE PRODUCTION BY METHODS OF MINING AND MECHANICAL CLEANING, IN THE UNITED STATES, 1941-43, INCLUSIVE

	1941		1942*		1943*	
	Thousands of net tons	Percent of total	Thousands of net tons	Percent of total	Thousands of net tons	Percent of total
Surface stripping	55,072	10.7	63,000	10.9	70,000	11.9
Hand loaded underground	272,410	53.0	287,000	49.5	269,000	45.7
Mechanically loaded underground	186,667	36.3	230,000	39.6	250,000	42.4
Total production	514,149	100.0	580,000	100.0	589,000	100.0
Mechanically cleaned	117,470	22.8	142,000	24.5	150,000	25.5

* Preliminary.

TABLE 2.—PENNSYLVANIA ANTHRACITE PRODUCTION BY METHODS OF MINING, 1941-43, INCLUSIVE

	1941		1942		1943*	
	Thousands of net tons	Percent of total	Thousands of net tons	Percent of total	Thousands of net tons	Percent of total
Surface stripping	7,317	13.0	9,071	15.0	9,900	16.4
Culm banks and dredges	5,174	9.2	6,020	10.0	6,400	10.6
Hand loaded underground	30,435	54.0	30,495	50.5	29,627	49.1
Mechanically loaded underground	13,442	23.8	14,742	24.5	14,400	23.9
Total production	56,368	100.0	60,328	100.0	60,327	100.0

* Preliminary.

* Messrs. Young, Anderson, and Lamb are staff members of the Economics and Statistics Division, Solid Fuels Administration for War; Mr. Buch is Chief, Coal Economics Division, Bureau of Mines, U. S. Department of the Interior.

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as reported in 1942 by mine operators. Of all mechanical-loading equipment sold in 1943, mobile loaders furnished the greatest added capacity, with conveyors, scrapers and pit-car loaders following in the order named.

There were 1,046 mechanical-loading units sold for use in bituminous and lignite mines and 304 for the anthracite mines, or a total of 1,350. In terms of capacity the sales of loading equipment for bituminous and lignite mines decreased 33 percent in 1943 from the previous year and sales for use in the anthracite mines decreased only 3 percent during the same period.

Types of machines sold compared with units in use.—Table 5 shows the change in demand since 1934 for the different types of mechanical-loading devices. Mobile loaders in active use at bituminous and lignite mines increased from 534 in 1934 to 2,315 in 1942. Scraper units in use show little change during the nine-year period, decreasing from 119 in 1934 to 100 in 1942. Pit-car loaders are rapidly being replaced by other types of loading equipment. Conveyors equipped with duckbills and other self-loading heads increased from 157 in active use during 1934 to 1,065 during 1942, and hand-loaded conveyors increased from 574 to 3,145, during the same period. Mechanical-loading equipment of all types in active use at bituminous and lignite mines as reported by mine operators increased from 3,672 in 1934 to 7,105 in 1942, or 94 percent, while all types in use at anthracite mines increased from 1,907 in 1934 to 3,015 in 1942, or 58 percent, during the same period.

Total sales of all types of mechanical-loading equipment sold to the bituminous and lignite industry in

TABLE 3.—UNITS OF MECHANICAL LOADING EQUIPMENT SOLD TO BITUMINOUS COAL, ANTHRACITE, AND LIGNITE MINES FOR UNDERGROUND USE IN THE UNITED STATES, AS REPORTED BY MANUFACTURERS, 1936-43, INCLUSIVE

	1936	1937	1938	1939	1940	1941	1942	1943	Percent change, 1943 from 1942
Type of equipment:									
Mobile loaders	344	292	241	292	233	368	352	234	—33.5
Scrapers*	28	29	10	26	39	11	29	15	—48.3
Conveyors†	994	1,095	990	1,311	1,762	2,130	1,491	1,100	—26.2
Pit-car loaders	11	32	139	2	3	10	2	1	—50.0
Total, all types	1,377	1,448	1,380	1,631	2,037	2,519	1,874	1,350	—28.0
No. of manufacturers reporting	28	28	29	31	32	32	28	24	.....

* Reported as scrapers or scraper haulers and hoists.
† Includes hand-loaded conveyors and those equipped with duckbills and other self-loading heads. Sales of both loading heads and shaker conveyors were counted for the years 1936-41, inclusive, but the figures for 1942 and 1943 do not include loading heads separately.

TABLE 4.—TOTAL NUMBER OF UNITS OF MECHANIZED LOADING EQUIPMENT SHIPPED FOR USE IN EACH STATE OR REGION IN 1943
(L—Mobile loading machines; P—Pit-car loaders; S—Scrapers; C—Conveyors)

State and Region	Number of units of all types shipped in 1943	Types of equipment in approximate order of capacity in 1943
Northern Appalachian States:		
Pennsylvania	127	L.C.S.
Ohio	28	L.C.
Southern Appalachian States:		
West Virginia	381	C.L.S.
Virginia	23	L.C.S.
Kentucky	70	L.C.
Alabama	68	C.L.S.
Tennessee	17	L.C.S.
Middle Western States:		
Illinois	45	L.C.
Indiana	7	L.
Trans-Mississippi States:		
Arkansas, Oklahoma, and Iowa	106	C.L.
Colorado	24	C.L.
Montana and Utah	96	C.L.
New Mexico, North Dakota, Washington, and Alaska	18	L.C.
Wyoming	36	C.L.P.
Total bituminous and lignite	1,046	L.C.S.P.
Pennsylvania anthracite	304	C.S.
Grand total	1,350	L.C.S.P.

TABLE 5.—SALES OF MECHANICAL LOADING EQUIPMENT IN 1943[1] COMPARED WITH TOTAL NUMBER OF MACHINES IN ACTIVE USE IN PRECEDING YEARS

	Number of machines in active use as reported by mine operators									Number of machines sold as reported by manufacturers in 1943
	1934	1935	1936	1937	1938	1939	1940	1941	1942[1]	
Bituminous and lignite mines:										
Mobile loading machines	534	657	980	[2]	1,405	1,573	1,720	1,985	2,315	234
Scrapers	119	78	106	[2]	117	131	116	109	100	13
Pit-car loaders	2,288	2,098	1,851	[2]	1,392	873	697	607	480	1
Conveyors equipped with duckbills and other self-loading heads	157	179	234	[2]	346	559	656	788	1,065	[3]
Hand-loaded conveyors—number of units	574	670	936	[2]	1,526	1,834	2,263	2,807	3,145	[3]789
Anthracite mines (Pennsylvania):										
Mobile loading machines	14	1	[4]	[5]	[5]	[5]	[4]	[4]	[4]	.....
Scrapers	517	507	[4]504	539	545	535	[4]547	[4]505	[4]524	2
Pit-car loaders	25	22	[6]	[5]	[5]	[5]	[6]	[6]	[6]	.....
Conveyors equipped with duckbills and other self-loading heads	13	30	[6]	[5]	[5]	[5]	[6]	[6]	[6]	[3]
Hand-loaded conveyors—number of units	1,338	1,563	[6]1,790	[5]1,855	[5]1,831	[5]1,997	[6]2,189	[5]2,432	[6]2,491	[3]302

[1] Preliminary.
[2] Data for 1937 not available for bituminous and lignite mines.
[3] Sales of conveyors equipped with duckbills and other self-loading heads are included with hand-loaded conveyors.
[4] Mobile loading machines are included with scrapers.
[5] Mobile loading machines, pit-car loaders, and conveyors equipped with duckbills and other self-loading heads are included with hand-loaded conveyors.
[6] Pit-car loaders and conveyors equipped with duckbills and other self-loading heads are included with hand-loaded conveyors.

1943 amounted to 1,046 units, which was 15 percent of the total number in active use in 1942, while the total number of units sold to the anthracite mines in 1943 was 304, or 10 percent of the total in use in 1942.

Types of equipment purchased by regions.—Mobile loaders, scrapers and conveyors shipped into the various States and groups of States in 1943 and the estimated number of units in actual use in 1942 are shown in Table 6. West Virginia received the largest number of mobile loaders sold in 1943. All of the 234 mobile loaders sold in 1943 were shipped to bituminous and lignite mines.

There were 15 scraper units sold in 1943, of which the bituminous mines received 13 and the anthracite mines only 2.

There were 798 conveyors sold for use in bituminous and lignite mines in 1943, of which West Virginia received 317, or 40 percent.

Trackless Gathering Equipment.—Although the sales of rubber-tired self-powered haulage units decreased in 1943 from 1942, deliveries were made in 13 States in 1943 as compared with eight in 1942. Pennsylvania received the largest number of units in 1943, and Kentucky, West Virginia, Alabama, and Indiana followed in the order named. These units which are generally known as "shuttle cars" are used to transport coal from mobile loaders to a transfer station on the haulageway. During 1942 approximately 15 percent of the coal loaded by mobile loaders was handled by shuttle cars.

TABLE 6.—COMPARISON OF MOBILE LOADERS, SCRAPERS, AND CONVEYORS IN ACTUAL USE IN 1942 WITH SALES REPORTED IN 1943, BY STATES AND REGIONS

State and Region	Mobile loaders		Scrapers		Conveyors[1]	
	In use in 1942[2]	Sales in 1943	In use in 1942[2]	Sales in 1943	In use in 1942[2]	Sales in 1943
Bituminous and Lignite Mines						
Northern Appalachian States:						
Pennsylvania	475	52	12	5	865	70
Maryland	....	....	....	....	30	....
Ohio	150	11	....	....	200	17
Michigan	....	....	....	....	5	....
Southern Appalachian States:						
Alabama	55	12	50	1	340	55
Kentucky	180	15	....	1	370	54
Tennessee	5	9	....	1	105	7
West Virginia	550	63	5	1	1,300	317
Virginia	45	8	....	1	110	14
Middle Western States:						
Illinois	560	23	....	....	25	22
Indiana	140	7	....	....	10	....
Trans-Mississippi States[3]:	155	34	33	3	850	242
Total bituminous and lignite.	2,315	234	100	13	4,210	798
Anthracite Mines						
Pennsylvania	[4]	....	524	2	[5]2,491	302
Grand total	2,315	234	624	15	6,701	1,100

[1] Includes conveyors equipped with duckbills.
[2] Preliminary.
[3] Includes Arkansas, Colorado, Iowa, Montana, New Mexico, North Dakota, Oklahoma, Utah, Washington, Wyoming, and Alaska.
[4] Mobile loaders included with scrapers.
[5] Includes pit-car loaders and duckbills or other self-loading conveyors.

Mechanical Cleaning of Bituminous Coal

Sale of Mechanical Cleaning Equipment for Bituminous Coal.—The total capacity of mechanical-cleaning equipment sold for use at bituminous-coal mines in 1943 was estimated at 3,500 net tons of cleaned coal per hour as compared with 6,400 net tons in 1942. Installations were made in 10 states in 1943 and nine states in 1942. Some of this equipment sold in 1943 will not be placed in operation until early in 1944. In terms of capacity, about 40 percent of the installations were made at mines that had no cleaning facilities and the other 60 per cent were made as additions to or replacement of equipment at mines that already had cleaning plants. Installations in 1943 were greater in Pennsylvania than in any other state.

Good lighting and head protection are important in reducing accidents

New Developments and Progress In Safety

All out operation of our mines focuses attention on safety as a key production and manpower factor.

By J. T. RYAN, Jr.
General Manager, Mine Safety Appliances Co.

THE HIGH demands of war industries for coal and ore placed an unprecedented responsibility on mining officials to increase production and maintain safety standards in 1943. Both coal and metal mines were faced with a dwindling labor supply as miners entered the armed forces and migrated to industries such as shipyards and airplane factories, thus presenting an added burden to mine managements in carrying out safety programs. With mechanical equipment being operated at maximum capacity, problems of training newer and older employes to work safely were given the attention of supervisory forces. Although preliminary reports are available for the coal mining industry, statistical information regarding metal mine accidents has not been tabulated nationally for 1943.

However, with about 115,000,000 tons of iron ore mined in 1943 compared to 118,707,113 tons in 1942 and slight decreases in zinc and lead production and a slight increase in copper production in 1943 over 1942, it is expected that the fatality and injury rates in the 1943 mining of these critical ores will compare favorably with the final 1942 data which are given in Table I in comparison with 1941 figures.

In 1942, 73 percent of the iron mining fatalities and 75 percent of the nonfatal accidents occurred in underground operations where falls of roof or wall, handling materials and haulage were the primary causes. The other accidents which occurred in open pits and on the surface were caused chiefly by handling of materials, haulage and falls of persons.

At underground copper mines, the greatest number of accidents is reported as having been caused by falls of rock or ore from roof or wall, haulage and handling of materials other than rock or ore. At open pit operations, hand tools, machinery other than locomotives and power shovels, and falls of persons were causes of most of the accidents.

Eighty-eight percent of the total men employed in lead and zinc mining are in underground work where 92 percent of the accidents occurred. In this industry falls of rock or ore from roof or wall, haulage and handling ore and rock at the working faces were also the causes of the most of the fatal and non-fatal accidents.

Preliminary reports on coal show that about 589,000,000 tons of bituminous and 60,327,000 tons of Pennsylvania anthracite, a total tonnage of 649,327,000, were mined in 1943. This is a slight increase over 1942 production and apparently was accomplished with a lower fatality rate. The fatality rate per million tons, as shown in Table II, for the first eleven months of 1942 was 2.32 in comparison to a fatality rate of 2.20 for the first eleven months of 1943.

In 1943 there were eight major* disasters in coal mines of the United States in which 174 men lost their lives. Of these 161 men were killed in major explosions and 13 in a bituminous coal mine fire. In 1942 six major disasters, all of which were explosions, accounted for 127 lives. As shown in Table III, less serious explosions claimed additional lives.

The increase in fatalities from explosions is in contrast to comparative data for other causes of accidents which show decreases in fatalities from falls of roof and coal, haulage and electricity in 1943 over 1942. Explosions are third in the list as a

TABLE I*

	Number of Mines	Men Employed	Man Hours Exposure	Men Killed	Men Injured	Per Million Man Hours Killed	Per Million Man Hours Injured
Iron—							
1941	322	25,870	54,910,720	47	1220	0.86	22.22
1942	327	28,956	66,992,925	56	1579	0.84	23.57
Copper—							
1941	100	21,576	55,130,086	62	2961	1.12	53.71
1942	107	23,222	60,390,109	50	2985	0.83	49.43
Lead and zinc—							
1941	338	8,634	16,917,070	12	992	0.71	58.64
1942	430	9,555	21,109,069	12	1131	0.57	53.58

* Source: Mineral Industry Surveys, United States Department of Interior, Bureau of Mines.

* A major disaster is defined as a mine fire or explosion in which five or more persons are killed.

cause of fatalities, the deaths from haulage accidents are listed second, and fatalities from falls of roof and coal are in first place, the latter accounting for about 50 percent of all fatal accidents in coal mines.

In combating the hazards which are the primary causes of fatalities and injuries in coal and metal mines, management in cooperation with various agencies has undertaken a vigorous program of education of supervisors and workers, increased supervision and inspections, progressive elimination of hazards either by their removal or changes in mining practices. This is apparent from reviews of data on this subject.

In keeping roof fall accidents to a minimum the wearing of protective hats and caps is a big factor. Almost 100 percent of metal mine employes and about 85 percent of the men employed in coal mines have this protection.

TABLE II*

Period	Anthracite Men Killed	Anthracite Killed per Million Tons	Men Killed	Killed per Million Tons	Total Men Killed	Total Killed per Million Tons
Jan.-Nov., 1942	1153	2.175	208	3.758	1361	2.324
Jan.-Nov., 1943	1091	2.046	204	3.685	1295	2.20

* Complete information on fatalities for twelve months of 1943 is not yet available from the Bureau of Mines and data given is subject to revision.

TABLE III

** Lives Lost and Injuries Resulting from Coal Mine Fires and Explosions

	Number	Men Killed	Men Injured
Major Explosions in 1942	6	127	2
Other Mine Fires and Explosions in 1942	21	27	45
Total	27	154	47
Major Mine Fires and Explosions in 1943	8	174	30
Other Mine Fires and Explosions in 1943	28	23	64
Total	36	197	94

** Source: United States Bureau of Mines.

Attention is given to roof hazards at working faces and along haulage roads. Timbering systems have been improved particularly where mobile loading equipment is in use and roof control is a subject of active discussion in practically all meetings to reduce roof fall accidents. Better lighting has been given considerable study in the eliminating of roof fall accidents and there is an increasing number of electric cap lamps in use in coal and metal mines.

The elimination of haulage accidents is sought by the adoption of automatic couplings; improvements in track beds and equipment; providing adequate clearances along underground and surface haulage roads, installation of automatic or manually operated signal systems; the more general use of trip lamps on rear ends of trips; the guarding of trolley wire; the proper training of motor crews in safe operation of their equipment; increased use of stop blocks and derails at slope haulage mines.

Improvements in ventilation have been made in coal and metal mines by the installation of new fans in some mines and higher capacity fans at others but of particular interest is the large number of changes in the present ventilation systems of coal mines. Among the outstanding improvements are included: the erection of brick stoppings instead of gob wall; keeping air courses clean and the building of new overcasts; better maintenance of line brattice at faces of gassy mines; construction of fireproof fan houses; change over from continuous to split ventilation in many small mines; elimination of practice of passing air through old workings before it enters active working places; the installation of double doors instead of single doors on haulage roads and the installation of signalling devices on fans to indicate any stoppage.

Ventilation changes and studies are indicated by the increasing interest

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in the application of anemometers, altimeters, methane detectors and testers, and other devices to aid in proper air distribution.

In ventilation improvements at many mines, dust control is of importance. This is accomplished usually by wet drilling, water sprays at loading points, along haulage ways and in tipples. Where dust concentrations are unhealthful and the

New pocket-size methane tester for quick analysis of mine air

For fire protection and water sprays—the large capacity mine fire truck

In metal mining too, effective light and protected heads are essentials

ventilation provided is not sufficient to remove the dusts from working areas, the wearing of approved airline or filter type respirators is practiced.

For greater efficiency and to reduce chances of fires and explosions, much attention is being given to electrical installations. There is an increased tendency to ground electrical equipment; to "bridge" trailing cable at shuttle car crossings; to splice and vulcanize cables properly; to provide better installations of wires underground through doors and stoppings and to fire-proof underground electrical stations.

Fire hazards at many mines were removed by the replacement of wood linings in shafts with concrete linings and by removal of structures having fire hazards from proximity to surface openings. During the past year there was an increase in the number of fire extinguishers made available and the adoption of fire trucks for fighting underground fires by coal mining companies. Other safety practices included the more general application of rock dusting; the adoption of safety belts for car droppers and workers climbing derrick masts or working above or in shafts and other hazardous locations; the building of man-trip waiting stations with seats; providing salt tablet dispensers at some metal mines and the installation of a larger number of underground first aid stations.

Emphasis was placed on proper storage, handling and transportation of explosives for compliance with the Federal Explosives Act, which resulted in safer magazines and practices.

Although there was a decrease in first aid training, this was partially offset by other educational work carried on by the Bureau of Mines, the National Safety Council and other agencies interested in promoting safety. The Bureau of Mines introduced mine safety classes in accident prevention work and maintained the mine rescue training courses at many coal and metal mines. In addition the safety facilities of the Bureau of Mines were made available to more companies through Safety, Coal Mine Inspection and Mineral Production Security Divisions, the personnel of which worked in close cooperation with operating officials. The facilities of the National Safety Council were expanded and a Coal Mining Section was organized in 1943 to further promote safety work in the coal mining industry. The Mining Section of the National Safety Council, which formerly included coal mining, will continue to function and expand its work in the interests of metal mining particularly.

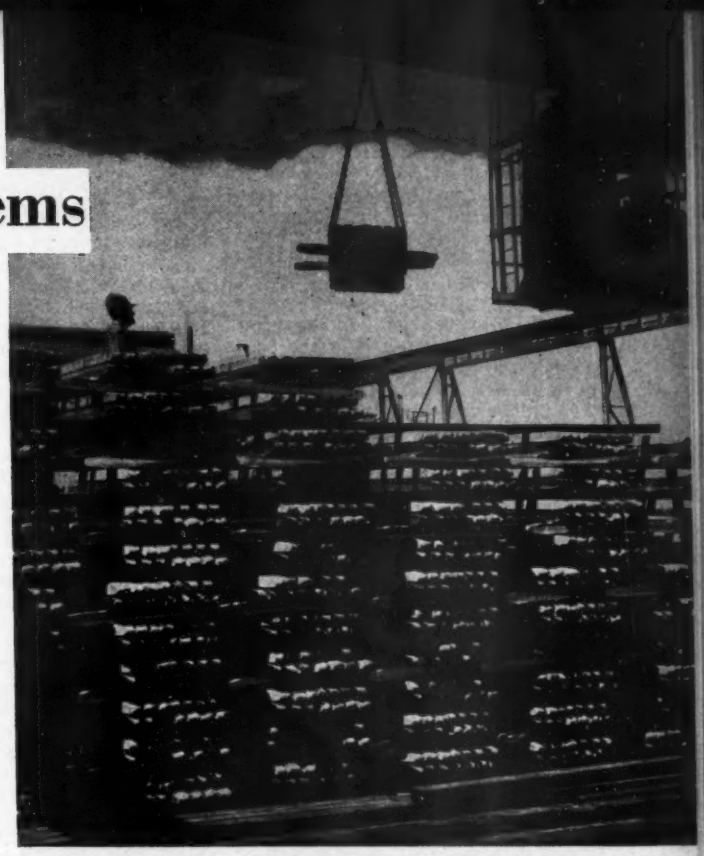
The formation of a Committee to Conserve Manpower in the Coal Mining Industry by Preventing Accidents made rapid advances under the direction of Mr. Thomas Moses in 1943 in establishing organizations in coal mining states. The principal objective of the National Committee in association with the Coal Mining Section of the National Safety Council is to assist State Mine Inspectors whose duty is to promote safety practices in mining of coal. It is planned through the organization of operator, management, miner, inspector and safety engineer in each Coal Mine Inspection District to have a properly coordinated group to reduce accidents and mining hazards.

Mining safety was given prominence at meetings of other national and local organizations during the year as it is generally recognized that one of the best means for the conservation of manpower is in the prevention of accidents in coal and metal mines. This real effort to improve safety records and conditions must be continued as it is a major contribution to winning of the war and to the future welfare of the nation.

Ease of handling and mobility in trackless locations are features of semi-portable rock dust distributor

Some Major Problems in the Field of Minerals and Metals

Progressive formulation of National mineral policies to meet the requirements of global war; stockpiling and development of mineral reserves for the future.



Loading bars of copper at Anaconda's Great Falls refinery

By ARTHUR H. BUNKER
Vice Chairman for Metals and Minerals
War Production Board

IT IS an extreme pleasure to have this opportunity of addressing you. As far as Metals and Minerals are concerned, coming to Denver is returning home for me, since for 10 years following the termination of the last war, I was engaged in the development of mineral resources in this district. During the intervening years, I have continued to be actively interested in the mineral world and 1941 found me, almost by chance, in the Office of Production Management, charged with planning the aluminum and magnesium systems needed for the prosecution of this war. The problems of light metals have consequently had my exclusive attention until a month ago. Then, I was asked to broaden my activities and take over the supervision for the War Production Board of all metals and minerals. I have not, therefore, had sufficient time to refine my views on the many problems before us.

However, I do feel sound in saying that the problems ahead, which are difficult, are also quite different in nature from those that confronted us two and three years ago. They are just as complex. If anything, they require more careful thought and deliberation than those of solving an immediate urgency in the high pressure days. Many require a long-range point of view, and all will certainly demand the highest degree of economic statesmanship on the part of industry, labor and government if they are to be resolved correctly.

It seems to me that this joint session of the American Mining Congress and the Colorado Mining Association is an ideal forum in which to consider these problems, and to forward their solution.

First I should like to make a brief review of the manner in which we as a nation have operated in the field of minerals in recent years. This seems to me an essential preliminary to considering the problems of the future.

Difficulty in Arriving at National Policy

National policy and its implementation are not easy to come by. Responsibility under our form of government is greatly divided. To reach that point where even well-laid plans can become national policy is necessarily a slow and difficult process. We are vociferous, we align ourselves in special groups, we argue for a righteous cause, but frequently with such vigor that we convince ourselves it is the only cause, and blind ourselves to the further aspects of the problem. This makes for inaction, not action. This stalemate can only be resolved by broader consideration of the whole problem and by further education of all the people vitally affected by the issue.

A splendid illustration of the difficulty of arriving at national policy and its implementation occurred in the field of minerals over the past four years of crisis. Offhand one might expect that after September 1, 1939, when war was on, national policy could have only one purpose—to hurry to an all-out effort of mineral acquisition, to make up for our extraordinary neglect of 25 years.

Many such plans were in existence, carefully prepared and adequate, but it takes more than plans to write national policy, it takes common agreement. Here is the history.

From 1939 to December, 1941, while war raged in Europe, our country was undecided as to whether it would become embroiled. Unfortunately this period succeeded two decades of disarmament treaties, a determina-

Address presented to combined meeting of the Western Division, American Mining Congress and the Colorado Mining Association, Denver, Colo., January, 1944.

tion to stay out of war, a determination so controlling that it impeded taking adequate measures to defend ourselves against war. Stockpiles of strategic and critical materials were discussed in the armchair, but not acquired; they were carefully listed and classified, but they were not purchased.

In 1939 the first minor step was taken to rectify our mineral position. This was reflected in the passage of the Strategic Materials Act. This authorized the appropriation of $100 million for expenditure over the succeeding *four years* to build stockpiles of strategic and critical materials. Under the terms of the Act, advertised bidding was mandatory and private negotiation prohibited; certainly not an Act reflecting serious urgency in amount or terms. And in addition, a half million dollars was allotted over the same period for investigation and development of domestic minerals and metals, not enough to carry on more than one pilot plant operation.

From April through June, 1940, events began to speak in strong language. Scandinavian countries were occupied, the Low Countries were taken and France surrendered. This brought change in policy, but still no "all-out" measures.

It is true that the restrictive features of the Strategic Materials Act were recognized and speedier methods of purchase were arranged. The responsibility for procurement of metals and minerals was in part turned over to the Reconstruction Finance Corporation, which promptly formed the Metals Reserve Company.

By May of 1941, it was realized it would be necessary for the government to preempt existing industry stocks, with a view to reallocation to defense uses. But measures were still moderate and cautious. The country was badly divided on the issue of war. The "business as usual" aspect prevailed. It was born of a desire for our usual way of life and amplified by those who sincerely believed that to do more was to encourage war. While bitterly opposed by others, this opinion prevailed on balance.

The shipping situation became even tighter, and consumption of many of our metals, such as aluminum, copper, scrap iron, zinc, cobalt and nickel, outran current supply. Priorities were initiated.

We moved slowly to conservation measures and curtailment of civilian uses.

Events themselves by now had made the problem of acquiring foreign materials vastly more difficult. We wanted chromite from Turkey, graphite from Madagascar. For the former, we faced shipping difficulties on the Mediterranean; for the latter, blockades. We wanted tungsten from China, cut off by the first closing of the Burma Road. Later, tungsten moved from here only by air.

All-Out Production Finally Called For

When war came, we had behind us a cautious policy of expanding domestic production. Much foundation work had been done by both government and industry, but war found us in an economy of scarcity and war banished overnight the question of cost, and caution and "business as usual," but we still did not reach an "all-out" policy.

But with war came the submarine, and its cost in imports. Tin imports ceased, bauxite losses from the Guianas were heavy, shortages of bottoms delayed us, even where production was available if we could move it. And at the same moment, we came face to face for the first time with the full impact of requirements.

We had been constantly recalculating our future requirements. Assumption was piled upon assumption in an effort to determine future demand, but when war came, almost all calculations had to be drastically revised upward. When the President made his famous speech of January 6, 1942, on planes, tanks, guns and ships, those of us responsible for supply of individual metals sat through many midnights translating these weapons into requirements for materials, and always we reached new and staggering heights. We saw no way under the sun by which we could reach these dizzy levels. So they seemed then.

Looking back, it is apparent that it is quite impossible to measure the full task of war until a nation is committed to war.

For example, it was found that the need for material per unit of production was far greater under conditions of hurried manufacture than was true in times of peace. Designs were changed rapidly, reaching 1,000 changes per month in one prominent plane model. Many goods were obsolete the day they were shipped. All these forces increased the demand for materials. Under these conditions supplies which had looked comfortable became alarmingly short in terms of new estimates. For the first time, it was concluded to "pursue with all dispatch the development and expansion of domestic supplies of ores." There were no then known strategic or critical minerals that did not come in for maximum attention. By February, 1942, Metals Reserve announced the first premium price plan for lead, zinc and copper. In addition, many contracts were placed for special minerals, at home and abroad.

And almost immediately the efforts of the Allies to secure and apportion materials resulted in the formation of the Combined Raw Materials Board, consisting of American, British and Canadian representatives.

Full scale facilities were undertaken to use completely new technical processes, some that had been demonstrated only in the laboratory.

Special attention was given to those commodities formerly imported from the Far East, and Limitation Orders were extended to severely curtail civilian consumption of such items.

By March of 1942, the priority system, based as it was upon the theory that there was enough for all, and that only the order of delivery should be controlled, came to its end. It gave way to a new system, "The Production Requirements Plan," to enable closer control and distribution of scarce materials, by a rough overall measurement of total supply and total requirements.

By midyear it became evident that there were developing increasing shortages of manpower and equipment. In order to reduce the demand for these, a general policy was undertaken cancelling all projects heretofore approved which would require for their operation more materials than could be supplied, it being recognized that to try to build all these facilities concurrently would be to delay the completion of all. This was a most constructive decision.

For the last six months of 1942, there was a definite improvement in the shipping situation, some improvement in method for controlling the flow of materials, but offsetting these advantages there developed a still further shortage of labor and equipment. To meet this manpower shortage in the minerals field, the War Manpower Commission and the War Department joined in releasing, subject to call, from the Army 4,000 miners.

It was evident that still tighter controls would be needed to regulate the flow of materials. By November, the Controlled Materials Plan was announced, bringing steel, copper and aluminum under more rigid measurement and allocation. Shortly after, the raw materials situation showed its first signs of easing.

Meanwhile ultimate policy had not been resolved. By request, Mr. Howard Young and his Joint Committee submitted a report on April 5, 1943, outlining six major recommendations for national policy with respect to critical and strategic mineral production. The most important declaration was that, "it was national policy to get the maximum possible output domestically and also to bring in as much as we can from overseas." It was declared that factors of labor, materials, transportation and time should prevail over money cost.

It was no longer wise to expend labor on low production mines when it could be used elsewhere more advantageously.

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So "all out" policy for mineral production was finally reached nearly three and one-half years after September, 1939. The first two years of this period, when shipping and manpower were relatively free, could have been made to yield great returns.

Thus this past four years is a powerful demonstration of the great forces needed to clarify issues and bring forth policy. Certainly it is true that if in 1939 the nation had found itself in common agreement as to what the future was to hold, policy would have been easy to write, and it would have been a policy of no hesitation. But these years demonstrate all too well the difficulty in democracy of unifying opinion, which is, of course, the necessary preliminary to the adoption of policy. In preparing to write policy for the future, we should bear this in mind.

Where has this series of policy changes and the resultant action brought us? Where do we stand today with respect to metals and minerals?

While national policy was in the making, there had been many other forces at work. Much of industry had seen impending disaster and made great contributions by preparing for it. When the full history of this industrial effort is written, great credit will be given its foresight.

But the really great achievement occurred when industry was called by government and shown the full task. Imagination, skill, ingenuity, indomitable determination, disregard for difficulty, welded together an industrial plant beyond any reasonable expectations. For nearly three years, I have called in industry again and again, shown them the government's requirements, explained the urgencies, asked for the impossible—and had it. It was the source of new courage to many of us.

Stockpiles Now Adequate

As a result of all of this, we have on hand adequate stockpiles of metals and minerals for the prosecution of all-out total war. By adequate stockpiles I naturally mean stockpiles which in conjunction with expected production and imports will maintain adequate and comfortable protection.

There are, of course, cases in which metal supplies are dangerously tight. In others, to continue operations at present capacity would produce substantial surpluses over requirements for those uses which are now permitted. In still other cases, the anticipated level of consumption was never reached and accordingly we have built extensive stocks and have remaining commitments to acquire more.

There is a general atmosphere of surplus about. I see it in the press, I hear it on the radio, I see it in the requests that are pouring in for relaxation of restrictive orders.

Actually, the problem needs great clarification.

We may be shutting down some steel furnaces, but we are not filling the full war demand for plate. We have shut down plants for producing primary aluminum to the extent of 350 million pounds a year but we are still coping with backlogs in forgings and certain forms of castings.

It is fair to assume, however, that the condition of true surpluses of many metals and minerals will shortly predominate so that it is timely to examine what the problems of such a condition are. It is evident at the outset that if these surpluses were freely released for manufacture into peace-time goods, they would use up large amounts of labor and many component parts.

No one wants to consume primary metals as such. It will interest you to know that in aluminum the entire cost of facilities and equipment necessary to produce pure electrolytic aluminum constitutes only one-half the cost of the over-all facilities needed to put this material into usable form. Further, it requires only one-sixth the labor to produce the primary metal that it does to complete the fabrication. And, rarely does anyone want to use aluminum in the form in which it leaves the fabricating plant, except to form it, machine it, and incorporate it into a finished article, requiring many other components and still more labor.

Until mid-1943, it was generally true that the degree to which fabricated metals were available determined the rate at which finished articles of war could be produced. This is no longer a valid index of possible production and any conclusions based upon this assumption are far from the facts. In general, the raw material situation has run ahead of the rest of our industrial machine. If there could be only one index of ability to produce, it would undoubtedly be the index of available labor. At the present time, there are many military programs that are far from schedule. It is true that there are free pools of labor in some areas, but definite shortages in others. It may be true that we have reached a peak of industrial production, but it is not possible to know whether we can maintain the going level for the full year, as we release from industry that amount of manpower needed for the military. And it is true that we must have 15 percent more production of military goods this year than last.

Military Task Still Ahead

Nothing should be risked against the complete fulfillment of this military task. We can all agree this must be national policy in capital letters. You may disagree in the measurement of the problem as made by the many government departments. You may feel there is freedom to do other things that your government does not. But you will agree it is an exceedingly complicated question, and where

Pine Creek Plant, U. S. Vanadium Corp.

there is doubt, there can be only one national policy and that is to weigh it on the side of winning the war.

It is indelibly clear that we have not reached any peak at all in our fighting. That unhappily lies ahead in every area of war. It is too easy to feel we have out-produced the enemy and that settles the matter.

But the fact is that even in the European theatre, the great engagements lie ahead. The fact is none of us knows what those engagements may tell, how well or ill we will fare, what the time table of events may be, how prolonged or how great our sacrifices, or whether we shall need to extend ourselves industrially to meet new demands. We know we must undertake invasion. This can only be a most perilous adventure. No greater damage could we do than to fail to be constantly aware that this is so. To reach for ease before we have won the right to it could be disastrous. I fully understand how it is possible to feel more comfortable than we have any right to. The war is so far away, and we are so occupied at home. We have a vigorous free press and radio that capitalize good news. But the common comment from the soldier at the front who hears this news on his radio is that it doesn't seem that way out where he is in the European theatre or the South Pacific. I see many of them as they return. They know the war lies ahead.

So that from now until we engage the enemy in full force, and see what that may mean, it must be national policy to examine with almost microscopic care every possible relaxation.

I feel sure that all relaxations which can be safely permitted at this time will fall far short in many cases of using all the metal we can produce.

We must have cutbacks in production. The war demands it. We need the manpower that can be released from building up surpluses that are not going to be used in this war. I am mindful that certain goods, not deemed essential two years ago, because of a plentiful supply in hands of our people, have now become essential. In the interests of efficiency, those goods should be made where it can be clearly determined they do not interfere with war. But cutbacks in metal production must still be made.

Cutbacks raise a number of difficult questions. Where to cut back? Should we use solely the yardstick of cost? We have many complicated considerations. We can import some minerals from abroad at lower costs than they can be produced at home. In these cases, we save manpower and money. We have some commitments abroad and at home that are not subject to immediate termination. We have a "good neighbor" policy to implement, which has been of great benefit to us in this war. There are many countries that are almost entirely dependent upon our trade and it is clearly evident that a change in contract with them could have far greater repercussions than a minor alteration of our own production schedules. It is clearly in our interests to weigh all of these matters in arranging for cutbacks, which are now inevitable.

The next period, that is the intermediate period, between the termination of European hostilities and victory in the Far East, will represent very different conditions. It seems reasonable to suppose that the general level of production of war goods might be substantially reduced, possibly by 30 percent. Obviously this reduction will not be horizontal. The production of some articles will not be reduced at all, and the production of some others will be considerably more than 30 percent. This might release several million workers for other activity. There should be no trouble in employing them. The trouble will be rather one of carefully selecting those activities of the greatest relative urgency and arranging to engage in them without interfering with the still gigantic war production. And that should also be a period when we should be mindful of the termination of war itself, the problems brought about by the termination of all war contracts and the return of men to civilian life. We could, it seems to me, do much during this intermediate period to see that any workers released from war work shall be engaged in activities which help in part to prepare for this transition period.

Post-war Problems Call for Careful Planning

The real problems come when the war is over. We must be prepared to answer them promptly, wisely and effectively.

There will be tremendous surpluses of many metals in terms of ordinary peace-time demand.

There will be a crying need for immediate international trade, and materials for reconstruction. And nations cannot wait while we debate methods of payment for these goods. They cannot wait without creating new and fresh problems with which in the end we will have to reckon, if only upon an economic basis.

We will have depleted our mineral resources by enormous amounts and it will be in the national interest to see that steps are taken to explore for new deposits and to create new technologies.

There will be the question of how best to stimulate such work. And there will be the question of degree, even after accepting the principle.

And we shall always have the problem of seeing that our nation is adequately supplied with strategic and critical materials against any future emergency. And even for those minerals not strategic or not critical, we must have regard for the great depletion which the war has produced and must decide what we should do to replenish them.

Let us consider the first of these problems in more detail. Let us see what can be done about stockpiles. This will demand instant solution. The only way to provide an instant solution is to arrange for it beforehand.

It is true that a certain amount of material will be in government hands, the Metals Reserve Company, the military services, etc. But by far the greater part will be in the hands of industry. In many instances, the inventories will be extremely large in proportion to the invested capital or asset position. These companies will be seriously vulnerable to any price decline or, to say it another way, the pressure to move materials will be tremendous. It is, of course, true that industry after industry those stocks now on hand and in process are tre-

Typifying the use of strategic metals for defense is the airplane, in which they find necessary application in strong, light alloys

mendous in terms of any foreseeable peace-time needs. No matter how optimistic we may be about the future of aircraft, the wildest flights of fancy could not for years envisage a demand beyond say 10 percent of that of war.

And materials will come to us from all sources. Battle damage scrap, obsolescence of military aircraft, returned and used cartridge cases—all will feed a stream of metal into the secondary markets.

It has been inevitable that in the hurried production of military products, faced with the constant design change forced by combat experience, there have been produced huge quantities of obsolete material. The greater portion of it is all of special design and unsuited to any other use than that for which it was manufactured. Much of it must go back to the furnaces. Some of this can no doubt be accomplished while war is on, and can serve to further reduce the production of primary material and free labor for other activity. But I would venture that the greater portion will remain, to be disposed of later.

The nation has overproduced in the past, and paid the price of adjustment, sometimes very severe, under the ordinary supply and demand rules of the business cycle. But this present phase is way beyond any past experience. No matter how strongly any group may feel about the entry of government in business, here is a situation that all will regard as appropriate for government support and handling. This is only one of the many new economic rules the war has forced upon us.

Stockpile Policies for the Future

Many suggestions of merit have been brought forward for handling this problem. They all envisage the government taking over excess materials, either those owned only by government agencies, or these plus the excess supplies of industry.

They vary in their suggestions for establishing rules of disposal, some suggesting there shall be no disposal rights short of another war, and others suggesting that as demands for these products increase in periods of increasing industrial activity, they could be released up to some percentage, a minor one, of primary needs. Something of this order must be accomplished.

This is a matter of great import. Any plan will require the most carefully thought out policies and management of the highest ability and integrity. Such materials should be removed as far as possible from influencing the normal behavior of prices, neither depressing them under the magnitude of their weight, nor permitting them to reach too great heights, by too rigid a withholding from markets in a heavy demand period. There should be determined, for strategic and critical minerals, minimum amounts below which government security would permit of no release. Such a reserve of metals should in itself be one of the great deterrents to another war.

However, I do not believe that exact terms of control can be written in advance, only general rules of conduct, and arrangements to free such assets from any and all special influence. But quite definitely, I think that now is the time to establish such a device. If brought into being now, it could be a most useful instrument from the moment of its creation.

In the matter of post-war trade, the demand for goods abroad will be automatic. The ravages of modern war, the even greater destruction in many cases of occupation will have developed an instant need for all manner of supplies from food to the heaviest form of productive machinery. But the manner of payment remains in doubt. It is true that some substantial arrangements, although no doubt not adequate, have been made by the United Nations, through UNRRA and other agencies, concerning food, medical supplies and the like. These needs we hope will not be continuing ones, because the first thing all countries should accomplish is to rebuild self-sufficiency of food supplies to their national limit.

How to finance other fundamentally needed goods will be a matter of national interest. In our own common pool, and that of other nations, these requirements must be financed.

To cover some portion of this payment, it has been suggested that at least those critical and strategic materials which do not exist in this country be accepted as payment for supplies we furnish. Other suggestions go further and suggest that larger supplies of all other metals, whether produced in this country or not, be likewise received in payment. Either scheme would require that the government take over and stockpile these minerals or metals. They would in no event be needed for current consumption, a requisite in any private transaction. The government could establish a purchase price for such metals and buy them from its own nationals who would receive them in payment for the sale of goods abroad. These goods should be held under the same conditions as the stockpiles previously discussed.

I should favor facilitating an extensive arrangement of this nature. It would serve the dual purpose of promoting essential trade and rebuilding our own depleted resources.

Development of Future Domestic Production

Then we come to the general question of exploration and development

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of natural resources within our own boundaries. This is not of the same pressing nature as that of tremendous overhanging supplies of refined metals. It is not a question of depriving people of employment by virtue of surpluses. It is rather a problem of long range national planning.

Whatever views we may hold of the degree to which mineral reserves have been exhausted, all of us can agree, it seems to me, that we have made enormous drains upon our rich deposits.

There is always a current belief that mineral production can be greatly expanded by opening up many small and marginal mines. These mines have, it is true, made an excellent contribution to supply, but on a percentage basis their contribution has not been great. The large increases have come from the expansion of operations of the larger developed properties. There have been only minor changes in the geography of production. All steps should be taken to explore for new deposits and to open new areas. But we must face the fact that recent history indicates that with slowing rates of discovery, and the depletion of war, greater percentages of raw materials must come from abroad. This is a simple matter of arithmetic.

No one can doubt that we will need increasing amounts of metals year by year.

I have just examined an impressive study which shows the comparative annual rates of consumption of some 30 leading metals and minerals for this war as compared to World War I. At the top of the list is magnesium, the use of which is about 1,400 times as great, while the next greatest increase is in aluminum, with a consumption rate 20 times as great; copper nearly five times; petroleum nearly four times and steel nearly twice as great.

The study further shows that even before this war, the growth in metal and mineral consumption has been extraordinary. Using the high peak of World War I again as a base, the average consumption of metals in the peacetime years of 1935 to 1939 was 30 times as great in magnesium, 50 times as great in molybdenum, three times as great in aluminum, and almost as great in steel and copper as in this base period of heavy consumption.

One can only reach the conclusion that modern industrial development is

(*Continued on page* 97)

Copper Meeting Essential Requirements

Domestic production reaches record level and industry is set for a slight increase in 1944, if required.

By F. H. HAYES
Acting Chief, Primary Production Branch
Copper Division

THE YEAR 1943 witnessed the largest domestic copper production in the history of the United States. At the beginning of the year, the war program requirements were in excess of estimated production, and the War Production Board policy was to get all copper production possible. This, of course, was a continuation of the 1942 objective.

Operating conditions under wartime needs and regulations were not especially conducive to record performance. While copper stood high in the list for priorities on labor, machinery, equipment and operating supplies, the competition between copper and other essential industries for both labor and supplies was tough. The labor supply was decreasing due to: (1) needs of the armed forces as they expanded in size and (2) needs of all other war industries, which were expanding facilities and production. The machinery, equipment and supplies needed by the copper industry were also in demand for other essential war programs, and it was only by a system of priorities and allocations, which was started previous to 1943, that all these vital industries were assured of sufficient material to maintain continuous operation.

Manpower—The copper industry employs approximately 52,000 people in the mines, mills, smelters and refineries. Of this total, approximately 37,000 people are employed in the mines and mills. The accompanying tabulation shows how these employes were distributed among the mines and mills in the year 1943.

The labor supply in 1942 had dwindled during the year to such a point that it was necessary for the Army to furlough some 2,824 soldiers back to the mines in October in order to maintain production. The same cycle was repeated in 1943 except that relief was given earlier in the year, by transferring 3,158 soldiers from active duty to the Enlisted Reserve while they worked in the mines and mills. This action was completed early in September and was responsible for maintenance of production during the last quarter of the year.

In order to be of maximum help to production, the soldiers were allocated to the mines of highest labor productivity or where their addition to the working force would be of greatest benefit for the war program in the immediate future.

Development—In each of the last two years as the labor supply at the mines decreased, men were taken off development work and placed on production in order to maintain output of metal. In a number of properties, this policy has resulted in a deficiency of development work to the extent of threatening continued production at maximum capacity. It was necessary at some properties to put men back on development work during the year and the need will be increasingly important in 1944.

Housing—Housing was another bottleneck to production during the year. Mine and plant employes going into the armed forces often left their families occupying houses in the mining camps. The same was true of many miners who went into other war industries. Furthermore, housing facilities in many places had not kept pace with requirements for several years.

Additional housing was necessary at a number of plants in order to obtain increased production, and in some instances even to maintain previous production rates. A survey was made of housing facilities needed, which resulted in the Government constructing 1,826 housing units, and dormitories to accommodate some 520 men, and installing 660 trailers. This, of course, was in addition to housing projects initiated and installed by various mining companies at their own properties.

New Production Projects—During the year, four major projects for increasing production were brought in. Two of these are open pit operations, i.e. Castle Dome and Phelps Dodge Morenci extension, both in Arizona, and two are underground mines, i.e. Bagdad in Arizona, and Gray Eagle in northern California.

Also, three smaller projects were brought to the production stage, namely, Quincy Sand Reclamation Plant in Michigan, Vermont Copper Company in Vermont and Ohio Copper Company—Big Indian property in Utah. The full effect of these additions will be felt in 1944, although some production was obtained in the latter part of 1943.

Premium Price Plan—The Premium

EMPLOYMENT IN DOMESTIC COPPER MINES AND MILLS

1943	6 Open Pit Mines and Mills	13 Underground Mines and Mills	Total 19 Mines and Mills	Approx. Total All Copper Mines and Mills
January	10,415	20,073	30,488	37,700
February	10,488	20,037	30,525	37,800
March	10,281	19,705	29,986	37,200
April	10,050	19,173	29,223	36,500
May	10,137	18,681	28,818	36,100
June	10,212	18,381	28,593	35,700
July	10,668	17,590	28,258	35,400
August *	10,696	17,663	28,359	35,500
September *	10,756	19,031	29,787	36,900
October	10,678	18,859	29,537	36,700
November	10,650	18,788	29,438	36,600
December	10,842	18,517	29,359	36,500

NOTES:
The six open pit mines produce all the copper that is produced from surface mining in the United States.
The 13 underground mines produce 82 percent of all the copper produced from the underground mines in the United States.
The 19 mines produce 92 percent of all the domestic copper.
* 3,158 soldiers transferred from Army to mines and mills.

Address presented to combined meeting of the Western Division, American Mining Congress and the Colorado Mining Association. Denver, Colo., January, 1944.

Price Plan for Copper, Lead and Zinc was increasingly helpful in maintaining production during the year. Approximately 22 percent of the total domestic copper mine production received premium payments in 1943, whereas only 10 percent of the 1942 production was over quota and thus eligible for premiums. The difference in percentages does not necessarily mean a corresponding increase in production in 1943. It became necessary during the year to revise some quotas downward, thus increasing premium payments, because of increased costs and the need to get the production even at a higher price. In general, increased costs were due to wage increases, lower labor efficiencies chiefly due to the exodus of so many experienced men, lack of sufficient labor for efficient operation, necessity for additional development work and increases in the cost of materials.

It was apparent early in the year that the 17-cent price under the Premium Price Plan was not high enough to bring into production certain small properties, including those producing fluxing ores vitally needed at smelters in order to maintain the copper production rate. In May, an amendment to the Premium Price Plan established Special Copper Quotas for small mines which made it possible to pay more than 17 cents where a higher price was shown to be necessary to secure required production. A number of these Special Copper Quotas were assigned and still remain in effect.

In November, it appeared possible that production and requirements were approaching a balance and an announcement was made to the effect that all requests for Special Copper Quotas would have to be made by the end of the year in order to receive consideration. This announcement made no statement regarding the termination of existing quotas for special premiums.

Special Contracts—A property which produced more than 2,000 tons of copper in 1942 was not eligible to receive Special Copper Quotas. However, during the year, several such properties made individual contracts with Metals Reserve Company by which they obtained a higher price than 17 cents, and production under these contracts amounted to approximately 3 percent of the total domestic primary supply.

Foreign Primary Production

Foreign copper available to the United States was practically limited to the western hemisphere. The noteworthy point in the 1943 production picture was the fact that production increased slightly over 1942. Chile, of course, was the source of the major part of this copper, and the increases here more than offset slight decreases from other countries.

Operations were beset by the same difficulties regarding manpower and materials as were experienced by domestic producers plus the added hazards and hardships of transportation for water-borne copper and supplies. The amount of copper imported into the United States is more significant than production so far as the war program is concerned. Temporary stockpiles necessarily accumulate at plants and ports as shipping schedules are disrupted by the exigencies of war, but the amounts of such stockpiles have been surprisingly small, and the safe transportation a most creditable performance. Figures on imports are shown in the tabulation on the following page.

DOMESTIC PRIMARY COPPER PRODUCTION

Short Tons

	1943	1942
Open Pit Mines	591,747	545,414
Underground Mines	512,875	543,175
Total	1,104,622	1,088,589
Production on which no premium prices are paid	825,713	986,154
Production on which premium prices are paid	246,612	102,435
Production under RFC contracts	32,297	.....

4,000 ft. underground, Mt. Con mine, Butte, Mont.

Scrap Copper

The production picture would not be complete without mentioning secondary and scrap copper. However, the discussion here will be very limited. Naturally, the production of secondary copper and scrap increases when fabricating plants operate at maximum capacity and consumption of copper products is maintained at high rates. Some of this copper is returned to the supply stream and increases the amount of available copper. In the year 1943, of the copper used in brass mills, copper wire mills, brass or bronze foundries and other processors, approximately 45 percent was from secondary sources.

Refined Copper Stockpile

Figures on copper requirements for the armed forces and the most essential civilian needs cannot be published for obvious reasons, but it may be said that actual consumption of copper during the year was slightly less than the total supply. The result is an accumulation of a small stockpile of refined copper. This cushion is not large enough to withstand any appreciable shock.

Forecast for 1944

On the basis of an all-out effort for production, which includes an adequate labor supply and sufficient materials, with no work stoppages for any reason, the year 1944 could see the peak of domestic production under present plans. However, the estimated increase over 1943, itself a record year, would not be great. Increases in production from projects completed in 1943 and to be completed in 1944 will be offset to some extent by decreases in some presently operating mines. This applies particularly to underground operations.

The greatest problem facing production is an adequate labor supply. For two years now, the labor supply curve has dropped sharply during the summer months and was only brought back by the addition of soldiers transferred from the Army to the mines. It is anticipated that the same shortage will occur in 1944 under war conditions.

Foreign production of copper available to the United States is expected to be no greater in 1944 than in 1943. Two major projects for increasing production, i.e., Cananea in Mexico and Chile Exploration Company in Chile, will be completed during 1944, but there will also be some decreases.

The actual requirements for copper will, of course, depend on the progress of the war. Certainly the cessation of hostilities in either major theatre would make revisions of production schedules necessary.

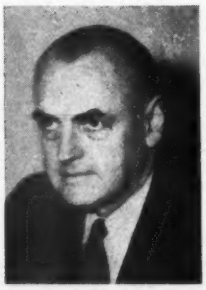
SUPPLY OF REFINED COPPER

Short Tons

	1943	1942
Domestic		
Refined from Ores including Cuba	1,124,000	1,081,000
Refined from Scrap	90,000	70,000
Total Domestic	1,214,000	1,151,000
Foreign — Imports	614,000	646,000
	1,828,000	1,797,000

Lead Holds Its Own

Firm domestic production is indicated to assure supply-demand balance.



By E. VOGELSANG

Chief, Tin-Lead Division
War Production Board

IT IS needless for me to tell you that lead is a strategic material.

World War I might be termed a "lead war" because of the type of military operations under which it was fought at the time, namely, "trench warfare." The most important ammunition in trench warfare where there are close concentrations of troops is shrapnel, vast amounts of which were produced in that period and came back to plague us after hostilities had ceased.

World War II is not a "lead war" in the same sense but nevertheless lead is just as vital a necessity in the production of our present instruments of war. The most direct military requirement is small arms ammunition into which lead enters as a tiny core within each steel jacketed bullet, and although the amount entering into the making of each single bullet is negligible the vast total amount of ammunition which has been produced to date has consumed hundreds of thousands of tons. Indirectly lead enters into the manufacture of practically every other instrument of war. Each submarine carries a heavy tonnage of lead in the batteries which drive it under the sea and also as ballast. Every naval and merchant vessel consumes large quantities of lead in batteries, lead-covered cables, tetraethyl lead for gasoline, pipes, sheets and paints, while airplanes, trucks, tanks, guns, gun mounts also require lead in some form. Immense quantities of lead have gone into the construction of plants to produce these war materials. Suffice it to say that in addition to the production of implements of war, lead has also entered into the maintenance of the essential civilian economy, in keeping our railroads, public utilities and automobiles in operation, in extending and repairing our communication systems, in the maintenance and repair of our homes, in agriculture for insecticides and even the lowly "collapsible tube" which has had to substitute for other more vital materials. In other words, lead is not being wasted in unessential uses.

The first stage of the war, namely, the construction of facilities and the filling of the pipeline of supplies to most fronts all over the globe is now practically completed but the "shooting war" has only begun and more and again more war materials must continue to be fed to armies wherever they may be, and unfortunately the end is no way near in sight.

On the other hand, through the patriotic efforts of the industry from the mine to the finished products, production of lead has been fairly well maintained, although, due to the inevitable manpower shortage, it has declined during the past year and is threatened with a further decrease during this year. Our estimates of production for 1944 are based upon a continuation of maximum production from those domestic mines operating during 1943. Under war conditions we are unable to supply the demand from domestic sources alone and the difference has had to be made up from imports.

Here I should like to give you the statistical picture in lead as we see it:

Address presented to combined meeting of the Western Division, American Mining Congress and the Colorado Mining Association, Denver, Colo., January, 1944.

	Short Tons
Total stocks, Government and Industry, Jan. 1, 1944	375,000
Estimated domestic refinery production during 1944	535,000
The domestic mine production is expected to be 440,000 tons, of which 425,000 tons will be produced as pig lead, the balance going directly into pigments, the remainder from secondaries and lead contained in imported concentrates.	
Estimated imports pig lead during 1944	275,000
Estimated domestic secondary during 1944	275,000
Total available supply	1,460,000
Total current supply during 1944	1,085,000
Estimated consumption and exports	1,115,000
Apparent deficit	30,000

At the moment we are estimating the consumption for 1944 to be 13,000 tons less than that of 1943, indicating a further drop in Government-held stocks. On the other hand, not being clairvoyant, our estimated consumption may be too high in which case, the Government-held stocks may remain steady. However, I urge you to make every effort to maintain domestic production at its best level, our domestic production being the only one which is safe from interference.

During the past two years we accumulated a substantial stockpile through the purchase of available foreign stocks. This Government stockpile reached its highest figure at the end of March, 1943, but has been substantially reduced since that time. Therefore, it is our best judgment that lead, while not critical, is also not in easy supply.

REVIEW and OUTLOOK for MINING

Current Zinc Outlook

Stabilized demand for zinc shifts industry's problem to curtailed production, increased stocks or relexation of restricted uses.

By M. L. TRILSCH

Assistant Director, Zinc Division
War Production Board

THE problems that the zinc industry will have to face during 1944 will be different in many respects from those which have confronted the industry up to now. During 1941 and 1942, and through most of 1943, the foremost problem was that of increasing domestic production and imports made necessary by the acceleration of military efforts and the adoption of the "Victory Program" following the declaration of war on December 8, 1941. Through Government's efforts, specifically, through control of distribution and curtailment of use, and the splendid cooperation of the industry this problem has been solved. During 1944 the major task confronting the industry, insofar as zinc is concerned, will be that of adjusting domestic production and imports to essential civilian needs and to military requirements which have reached, at least for the time being, a stabilized level, with a due provision for maintenance of an adequate stockpile. A decision will have to be made as to whether premiums paid for additional output should be continued either for the sake of increasing the existing stockpile or for the purpose of making it possible to release more zinc for uses which up to now have been considered as being not absolutely essential for the war effort.

Address presented to combined meeting of the Western Division, American Mining Congress and the Colorado Mining Association, Denver, Colo., January, 1944.

Review of Zinc Position in 1942 and 1943

During 1942 and 1943, the supply problem was approached from two directions: first, by stimulating the output of zinc from domestic mines and, secondly, by increasing imports of both zinc concentrates and slab zinc. The balancing of supplies against requirements was further aided by drastic curtailment of the non-essential uses of zinc.

As in the case of many other metals, the pre-war production of zinc concentrates was insufficient to meet the rapidly expanding requirements and the industry was faced with the task of expanding mine output. This was rather difficult in view of the fact that by the latter part of 1941 virtually all of the mines capable of producing zinc at the then prevailing price of 8¼ cents per pound were already operating close to their economic capacity. To provide a stimulus for increasing the output from domestic mines and to compensate operators for extra costs involved in bringing in additional output, a premium price plan was introduced in February, 1942. Details and workings of this plan are too well known to the industry to warrant its further discussion here. The premium price plan has resulted in the development and production of marginal and low grade ores that otherwise would have been left unexploited, and in the re-working of tailing dumps that had previously been commercially impossible.

As a part of the expansion program, the Zinc Division has also initiated a series of new mine projects, practically all of which have been already completed. Under this program, many operators were given financial assistance by the Reconstruction Finance Corporation, the Metals Reserve Company, of the Defense Plant Corporation. It is estimated that these projects, when in full production, should add about 151,000 tons of recoverable zinc per year. Had it not been for these additions, the production of concentrates during 1943 would have been much lower, for these projects have, at least partly, compensated for the loss of production occasioned by depletion of ore reserves and by labor shortages at other properties.

As far as imports are concerned, it may be pointed out that from a negligible quantity in 1938, they have been steadily increasing and presently account for a very substantial por-

Casting slab zinc—99.99+% pure metal

tion of the total supply of concentrates. Unfortunately, censorship regulations prevent the divulgence of any detailed information on either import or export statistics.

Concomitantly with the expansion of mine production of concentrates, many measures have been taken to increase the smelting and refining capacity of the industry. Among the major projects were the construction of an electrolytic zinc plant at Corpus Christi, Tex.; expansion of the electrolytic plants of the Anaconda Copper Company at Great Falls and Anaconda, Mont.; and an increase in capacity of the electrolytic plant at Monsanto, Ill., by American Zinc Lead and Smelting Company. It is estimated that the total increase in smelting capacity since 1940, as previously pointed out, has aggregated 166,500 tons of slab zinc per year. The results of these efforts can be gauged best, perhaps, by noting the increase in the smelter output of slab from both primary and secondary sources. Slab zinc production has risen from about 478,000 short tons in 1938, which was materially below the then existing capacity, to an estimated 990,000 short tons in 1943.

Another problem that confronted the industry during the latter part of 1942 was that of grade balance in slab zinc. There was at that time an insufficient supply of high grade slab and a surplus of low grade. To solve this problem, arrangements were made with one of the producers to refine low grade into high grade. Also, beginning with the third quarter, 1942, an agreement was negotiated with Canada providing for an exchange of low grade zinc for an equivalent quantity of high grade zinc. Toward the end of 1943 the grade balance had improved to an extent where it was decided to discontinue gradually the conversion of low grade into high grade zinc. These operations are scheduled to cease after April 1, 1944. The desirability of renewing the exchange agreement with Canada is also being presently considered.

Simultaneously with the efforts to increase production, various restrictions have been introduced to curtail consumption of zinc for non-essential needs. The first step was taken when, by the Presidential Proclamation of January 10, 1941, zinc, together with copper, was placed under export license control. Shortly afterwards, the American Zinc Institute set up a committee to coordinate the distribution of zinc to consumers. This attempt was a short-lived one as the committee found itself unable to solve the problem in the face of a rapidly rising demand. In March, 1941, the Office of Production Management established a pool by requiring producers to set aside a certain percentage of their monthly production for distribution by the Office of Production Management to defense industries. In June, 1941, General Preference Order M-11 was issued providing for mandatory control of the industry and designating the percentage of production to be set aside each month by producers for allocation by the Office of Production Management. With production lagging far behind demand, these measures proved insufficient and, therefore, in June, 1942, zinc was placed under complete allocation by the Office of Production Management's successor, the War Production Board. This step was necessary in view of the producers' inability to meet the demand and to decide which orders were to be given preference. Moreover, the adoption of this measure made it possible for the War Production Board to direct the flow of zinc into the vital defense industries and to prevent the accumulation of excessive inventories in the hands of consumers. In July, 1942, Conservation Order M-11-b was issued prohibiting certain non-essential uses of zinc and placing restrictions upon the consumption of zinc for other purposes. This order was later amended restricting the use of zinc still further. Concurrently, a number of the so-called "M" and "L" Orders were issued by the War Production Board restricting the manufacture of consumer goods and the output of many non-essential industrial products, and thereby curtailing greatly the consumption of zinc.

Control of zinc consumption and inventories is exercised through an allocation system. Allocations of zinc are made at the present time on a monthly basis directly to consumers, that is, to processors and manufacturers of zinc products, without first distributing the total available supply among the various claimant agencies as is being done with the CMP materials. The quarterly programs thus present estimates of zinc requirements by major consumer groups. There are approximately 560 consumers of slab zinc distributed as follows: brass mills, 38; steel mills, 71; job galvanizers, 174, zinc oxide manufacturers, 3; ingot makers, 57; foundries, 27; die casters, 37; rolling mills, 15; dealers, 85; and miscellaneous, 53. Brass mills are at the present time the largest consumers of slab zinc and account for 45-50 percent of the total current consumption. Steel mills and other galvanizers account for another 30-35 percent, with only 20-22 percent accounted for by all consumers.

The control over zinc scrap is exercised by the Zinc Division through the application of General Preference Order M-11 which restricts delivery of zinc scrap to a limited group of users, and through Conservation Order M-11-b which places restrictions on the end uses of zinc scrap identical with those placed upon the uses of slab zinc.

The net effect of all these measures during 1943 was to place the total consumption well within the limits of available supply and to increase available stocks by about 160,000 short tons of slab zinc and recoverable zinc in concentrates.

Outlook for 1944

The outlook for 1944 contemplates smelter output and imports of slab zinc essentially equal to those during 1943. Insofar as the supply of concentrates is concerned, domestic mine output is expected to be somewhat lower than in 1943 largely due to the anticipated decline in the Tri-State

Area, but the expected increase in imports will more than compensate for the drop in the domestic mine output.

Military requirements have been stabilized toward the end of 1943 at a somewhat lower level than that which prevailed during the remainder of the year, largely as a result of a downward revision of the ammunition program. Lend-lease requirements have been, likewise, materially reduced. Somewhat greater use of zinc for essential industrial and civilian needs can be anticipated, however, during 1944, particularly among the galvanized products. As in 1943, a net addition to stocks of about 210,000 short tons of zinc slab and recoverable zinc in concentrates is expected if the existing production policies continue. Under these circumstances, the total stocks at the end of 1943 are placed at about 628,000 short tons, and at the end of 1944 at about 838,000 tons. The above figures include operating inventories estimated at 400,000 tons. The stocks in excess of working inventories are estimated to be equal to about three months' consumption at the end of 1943.

One of the major difficulties that will continue to confront the industry is the shortage of skilled labor at mines, mills and smelters alike. As a result of induction of men into the armed service, smelters have been losing labor that is difficult if not impossible to replace. The output of several smelters has already gone down, and further loss of manpower may force a further reduction, if not a complete suspension, of operations at several plants.

Among the issues that should be resolved during 1944 will be the ultimate size of the stockpile. At the end of 1943 the total stock of slab zinc and recoverable zinc in concentrates, exclusive of working inventories, represented about three months' domestic consumption. Using the present estimates of supply and requirements for the year 1944, this stock will be increased to approximately five and one-half months' consumption at the end of 1944. Therefore, any determination as to the size of the stockpile which would be less than our present estimate at the end of 1944 presents two alternatives: (1) A curtailment of our production of mine output, or (2) an increase in the consumption of zinc by the relaxation of restricted uses.

Any curtailment in the mine production would involve the elimination of some or all premium subsidies presently being paid on zinc and the repercussions of such a program present the following problems:

REVIEW and OUTLOOK for MINING

(a) The effect on the production of lead;

(b) The loss of natural resources;

(c) The unemployment of manpower due to such curtailment.

Although it is very doubtful that any considerable increase in the consumption of zinc for uses that are being presently restricted will be effected in the near future, the possible resumption of the manufacture of numerous durable goods should be seriously considered before reaching a decision on the size of the stockpile.

Statistically the zinc position during 1942 and 1943, with an outlook for 1944, can be summarized as indicated in the above table.

ZINC CONCENTRATES AND SLAB SUPPLY, CONSUMPTION AND STOCKS, 1942-1944

(In thousands of short tons of slab zinc and of recoverable zinc in concentrates)

	1942 Actual	1943 Partly Estimated	1944 Estimated
Concentrates			
Domestic production and imports	1082.5	1193.2	1191.7
Stocks at end of year	307.8	352.0	416.0
Slab Zinc			
Domestic production and imports	988.4	1050.2	1057.9
Domestic consumption and exports	916.0	940.2	911.8
Stocks at end of year:			
Producer and Government	82.8	190.0	336.0
Consumer	76.9	86.0	86.0
Total	159.7	276.0	422.0

Iron Ore Wins Another Service Stripe

The iron ore industry assures the nation its most basic war material, continues its technologic progress and foresees continued heavy demands both for war and post-war reconstruction.

By M. D. HARBAUGH
Vice President
Lake Superior Iron Ore Assn.

DURING 1943, the iron ore industry of the United States, despite many set-backs, added another splendid chapter to its war record. Mines of the Lake Superior district, together with their rail and lake ore transportation facilities, achieved a notable task in the face of serious handicaps imposed by nature, most other districts increased their output, and by the close of the shipping season, the country again was assured that production of war supplies dependent on iron and steel is protected by adequate stocks of ore until the advent of another ore season.

From the figures available to date, total shipments of iron ore (including concentrate, sintered ore and Lake Superior manganiferous ore, but excluding by-product pyrite cinder and sinter) from all mines in the United States in 1943 are estimated at approximately 100,150,000 gross tons, a decline of 6.2 percent from the 1942 total of 106,780,000 tons. This decline is mostly attributable to the lesser movement of Lake Superior ore occasioned by the late opening of lakes and by frequent delays from unfavorable weather conditions and accidents on the lakes. Of the total ore shipments, the Lake Superior district provided approximately 86 percent in 1943 compared to 87 percent in 1942.

As indicative of what, a year ago, was expected to be the general magnitude of the iron ore output for 1943, the Director of the War Production Board, in late December, 1942, released an estimate of ore requirements necessary to meet anticipated operations of furnaces existing or to be completed, as follows:

TABLE 2—WPB ESTIMATE OF DECEMBER, 1942, SHOWING REQUIREMENTS OF IRON ORE FROM U. S. MINES IN 1943

Source	Gross Tons (Millions)	Percent of Total
Lake Superior	100.10*	83.70
Eastern	5.50	4.60
Texas & Missouri..	.80	0.67
Southern	9.50	7.94
Western	3.70	3.09
Total	119.60	100.00

* Evidently including expanded Ontario requirements of about three million tons from U. S. mines.

At that time it was indicated that the entire iron and steel plant expansion program would be completed before early autumn of 1943. This whole program, beginning in 1941, had included 24 new blast furnaces in the United States, and 4 others in Canada—3 of which would be dependent on United States ores—in addition to numerous other furnaces rebuilt, and in many instances, enlarged. However, delays in completion of these facilities were such that by the end of 1943, 8 of the new United States furnaces had not yet been completed or blown in. Those put into blast after September include the Republic DPC furnace at Cleveland (October 28), one Inland DPC furnace at Indiana Harbor (November 16), one Carnegie-Illinois DPC furnace at Braddock, Pa. (December 15), the new Canadian Algoma Steel Company furnace at the Soo (December 1). The first of the 3 new DPC furnaces at the Geneva, Utah plant was blown in January 2, 1944. These delays in completion of furnaces, and interruptions in furnace operations during the year on account of coke shortages attributable to coal mine stoppages, together with the fortunate maintenance of sufficient scrap supplies to keep down the volume of pig iron and of direct iron ore needed for open hearth use, resulted in the overall furnace requirements of iron ore being substantially less than had been anticipated for the year.

From the figures now available, total iron ore consumption in the United States in 1943 was about 101.1 million gross tons, of which 86.6 million was from Lake Superior mines and 14.5 million from other sources—domestic and foreign. This compares with 99.1 million tons in 1942 of which 83.7 million tons was from Lake Superior mines and 15.4 million from other sources. Thus, total United States mine shipments were nearly in balance with United States ore consumption for the calendar year, although in comparing such figures, it should be kept in mind that ore produced in the United States also is exported to supply most of the Ontario furnace requirements and some Canadian and other foreign ore is imported for consumption; also a deduction of about 1 percent must be made from mine shipping weights of lake ores to allow for shrinkage loss

TABLE 1—U. S. IRON ORE SHIPMENTS BY PRODUCING DISTRICTS*

District	1942 Gross Tons (Millions)	Percent of Total	1943 Gross Tons (Millions)	Percent of Total
LAKE SUPERIOR				
Minnesota, Michigan and Wisconsin.....	93.01	87.10	85.98	85.85
SOUTHERN				
Alabama (and including Georgia, Virginia, Texas and Missouri).....	9.21	8.63	8.53	8.52
EASTERN				
New York, Pennsylvania and New Jersey.	3.08	2.88	3.19	3.18
WESTERN				
Wyoming, Utah, California, New Mexico (and incl. Arizona and Washington)	1.48	1.39	2.45	2.45
TOTAL	106.78	100.00	100.15	100.00

* Exclusive of by-product pyrite cinder and sinter from various sources.

between mine and furnace. As to imports other than from Canada, some ore came into the eastern seaboard during the year from North Africa, as ballast in ships returning from war deliveries.

The new blast furnaces which were not yet in service by the end of September, 1943, are listed in the following table. Some of these have since gone into blast (as noted), and all but one of those dependent on Lake Superior ore, as well as the others, presumably will soon be in operation. In any event, the list gives some indication as to possible additional ore requirements, although new furnaces added are partly offset by old ones going down for repairs, relining, etc.

TABLE 3—NEW BLAST FURNACES BLOWN IN* SINCE SEPTEMBER, 1943, OR NOT YET IN BLAST

	Annual Pig Iron Capacity Net Tons
U. S. Furnaces dependent on Lake Ore	
Inland Steel Co.—*Indiana Harbor (DPC) (Into blast November 16)	390,000
Inland Steel Co.—Indiana Harbor (DPC)	390,000
Pittsburgh Steel Co.—Monessen (DPC)	375,000
Republic Steel Corp.—*Cleveland (DPC) (Into blast October 28)	418,000
Republic Steel Corp.—South Chicago (DPC)	418,000
Carnegie Illinois Steel Corp.—*Braddock (DPC)—"B" (Into blast December 15)	430,000
CANADIAN Furnace dependent on Lake Ore	
Algoma Steel Co.—*Soo—No. 5 (Into blast December 1)	375,000
U. S. Furnaces dependent on other Ores	
Sheffield Steel Co.—Houston, Tex. (DPC) (Texas and Mexican Ores)	311,000
Lone Star Steel Co.—Daingerfield, Tex. (DPC) (Texas ores)	333,000
Geneva Steel Co.—Geneva, Utah (Utah ores)	
*No. 2 (DPC)	375,000
No. 3 (DPC)	375,000
No. 4 (DPC)	375,000

* In blast.
DPC—Defense Plant Corporation.

Scrap Supply in Relation to Iron and Steel Production

Significant to iron ore producers and consumers is the fact that the supply of ferrous scrap was maintained during 1943 at high levels, permitting the record-breaking consumption of 55.5 million gross tons during the year, compared with the previous records of 53.8 million gross tons in 1942 and 52.9 million in 1941. (Corresponding net tons are 62.1, 60.2 and 59.2 million, respectively, as shown in Table 4, below.)

Two years ago, in February, 1942, when stocks of scrap on hand reached the low point and potential or dormant supplies were highly questionable, no one could foresee whether or not enough scrap would be forthcoming to maintain charging practices in the expanding furnace plants at anything like the normal proportions of scrap. Had the yearly supplies of scrap dwindled by several million tons—and no one could be sure they wouldn't—the manufacture of the steel in these past two years would have required correspondingly more pig iron. This would have necessitated more ore being charged to blast furnaces—insofar as capacity permitted—and higher iron charges in open hearths would have greatly increased the tonnage of ore and sinter used directly therein. Hence, due to the very satisfactory flow of scrap maintained thus far, the wartime demand upon the iron ore industry has been substantially less than it might have been. Obviously, the scrap industry and the iron ore industry have played complementary and vital roles in meeting the wartime needs for the raw materials of steel.

As noted in Table 4, steel production in 1943 was about 89 million net tons, an increase of 3 million over 1942; and output of pig iron and ferro-alloys in 1943 was approximately 61.5 million net tons, compared to 60.9 million in 1942.

TABLE 4—STEEL, PIG IRON AND SCRAP STATISTICS OF THE U. S.
(In Millions of Net Tons)

	Five-Year Average 1936-1940 Incl.	1940	1941	1942	1943
Steel Production† (Ingots and Steel for Castings)	52.3	67.0	82.8	86.0	88.9
Pig Iron Production† (Including Ferro-Alloys)	36.2	47.4	56.7	60.9	61.5
Pig Iron Consumption‡	34.8	46.2	56.2	59.0	60.3*
Ferrous Scrap Consumption‡ Total	37.6	44.5	59.2	60.2	62.1*
Purchased Scrap‡	17.5	19.5	25.3	27.1	26.7*
Home Scrap‡	20.1	25.0	33.9	33.1	35.4*

† American Iron and Steel Institute figures.
‡ U. S. Bureau of Mines figures.
* Figures partly estimated.

REVIEW and OUTLOOK for MINING

The Lake Superior District

The goal announced for the 1943 movement of Lake Superior ore at the beginning of the shipping season in April was 95,000,000 gross tons by lake, plus expected deliveries all-rail of about 2,000,000 tons. These figures were based on the estimated furnace requirements, as then appeared probable, for the 12 months up to the beginning of the 1944 shipping season. With the additional carrying capacity of five large vessels placed in operation during 1942 and of 16 more (United States Maritime Commission vessels) which were already under construction and scheduled to be put in service in 1943, the proposed tonnage appeared reasonably possible. But in marked contrast to the spring of the previous year, shipping opened a month later, due to ice conditions. Although the first vessel made Escanaba through heavy ice and was loaded April 4, the first into Lake Superior—with the aid of ice breakers—was not loaded until April 24, whereas in 1942 the season opened at Escanaba March 23, and at Marquette the 25th—the earliest opening on record. The last vessel loaded in 1943 was at Duluth on December 6, and in the previous year the last left Marquette on December 9. By the end of the 1943 season all 16 Maritime Commission vessels were in service, although most of them were delayed in completion far beyond the expected dates and some were in service for only a short time near the end of the season. There were finally 319 vessels in service in the United States ore fleet, with a trip capacity (at 20 ft. draft) rated at 2,984,490 gross tons, as contrasted to 306 vessels of 2,814,490 tons capacity at the end of 1942. Canadian vessels in the ore trade were 28, whereas 35 carried ore the previous year. Accidents took a heavy toll, as one large United States ore carrier— the *Humphrey*—was lost by collision in fog in the Straits of Mackinac in June (also a small Canadian vessel not in the ore trade—the *Prindoc*—was lost in Lake Superior the same month) and several others were damaged by collisions and groundings.

Despite the somewhat lessened need for ore, the past shipping season has

clearly emphasized the necessity for maintaining a substantial margin of safety in the lake ore supply to carry furnaces through a long winter, for weather still defies control and plays carelessly with the best-laid plans. The ice, fogs, accidents, and delays in completing new vessels, some just "bad breaks" in luck seemed to combine to thwart the efforts to meet the season quota.

An important aid to shipping was added during the season when the new MacArthur Lock at the Soo was completed well ahead of schedule and opened to traffic on July 11. This largest lock—879 ft. long, 81 ft. wide and 31 ft. deep—allows passage of boats loaded to deeper draft than formerly was possible, and thus, with the abnormally high water levels prevailing on the lakes during the year, contributed substantially to the carrying capacity of the fleet.

Continuing its valuable service of coordinating the movements of the various lake shipping facilities so as to move the maximum tonnage with greater efficiency, the Lake Vessel Committee, which was created in 1942 by the lake carrier and the Lake Superior mining interests, played an important part in expediting the movement of ore, coal and grain on the lakes. Through this voluntary agency of shippers and carriers, acting in cooperation with the Office of Defense Transportation and the War Production Board, the mining industry and the lake and rail transportation systems have made the most of the season's possibilities. More could not be achieved or even expected.

The new emergency loading dock started in late 1942 at Escanaba, the Lake Michigan port, was completed early in the 1943 season only to the extent of the timber structural work, no trackage or steel work being provided. This dock serves as a stand-by facility to be completed for service quickly if and when actually needed.

During the year, as the various situations affecting furnace requirements resulted in lessened over-all demands for ore, and the possibility of catching up on the delayed ore shipments grew remote, the War Production Board gradually reduced its goal for the lake ore movement to 86.5 million tons. Even though this was not reached by more than 2 million tons, there is no reason to expect any dire consequences as a result, because ore stocks available to consumers are adequate. The inventory of Lake Superior ore at United States and Canadian furnace yards and Lake Erie docks on January 1, 1944, was 43.4 million gross tons, compared with 47.4 million tons on January 1, 1943, and 40.5 million tons at the beginning of 1942. If, as now seems likely, the consumption of Lake Superior ore in the next few months does not exceed the average rate of the last quarter in 1943 (by both United States and Canadian furnaces), the residual consumer stocks would be in excess of 13,000,000 tons by May 1, to which would be added whatever new season tonnage is delivered by that date. With a normal lake opening in April, a substantial tonnage would be delivered in that month.

TABLE 5—LAKE SUPERIOR IRON ORE
In Thousands of Gross Tons

	1939	1940	1941	1942	1943
SHIPMENTS BY LAKE					
From U. S. Lake Ports	45,002	63,353	79,655	91,604	83,961
From Michipicoten-Canada	71	360	461	473	444
Total by Lake	45,073	63,713	80,116	92,077	84,404
SHIPMENTS—ALL RAIL					
From U. S. Mines	436	595	1,094	1,396	2,016
From Canadian Mines	39	1	.....	14	1
Total All-Rail	475	596	1,094	1,410	2,017
TOTAL SHIPMENTS	45,548	64,309	81,210	93,487	86,421
ORE CONSUMPTION					
By U. S. Furnaces	43,480	61,033	74,571	83,714	86,585
By Canadian Furnaces	881	1,393	1,765	2,511	2,442
TOTAL CONSUMPTION	44,361	62,426	76,336	86,225	89,028
STOCKS ON HAND—U. S. & Canadian—at Furnaces & Lake Erie Docks					
On May 1	22,791	18,106	16,937	20,065	18,497
On December 31	35,440	36,073	40,457	47,424	43,429

Recent decline in pressure for iron and steel production in some areas is clearly evident as a result of lessened needs for certain war supplies and shifting of production to others. This fact, coupled with the actual record of ore consumption during 1943, at least suggests that the recent rate of lake ore consumption may not be much, if any, increased during the next few months, even though the remaining new furnaces for use of lake ore are put into blast. Other furnaces in need of repairs and relining may be expected to shut down, thus balancing the operations. It is worth noting that the peak for all-time in consumption of lake ore was reached in January, 1943, at 7,765,000 gross tons; consumption was 6,940,000 tons in June, 7,751,000 tons in October, and closed the year at 7,509,000 tons in December.

The above tabulation contains the significant figures relating to shipments, consumption and stocks of Lake Superior ore, both United States and Canadian, during the past five years.

Of the lake shipments during 1943 totaling 84,404,852 gross tons, Minnesota supplied 68,382,306 tons or 81.01 percent; Michigan and Wisconsin, 15,578,516 tons, or 18.46 percent; and Michipicoten (Ontario), 444,030 tons, or 0.53 percent. Corresponding total figures for 1942 were 92,076,781, of which Minnesota supplied 74,309,252 tons, or 80.71 percent; Michigan and Wisconsin, 17,294,658 tons, or 18.78 percent; and Michipicoten, 472,871 tons, or 0.51 percent. Of the Michipicoten output, over 60 percent moves to furnaces in the United States, partly in exchange for ore from United States mines which supply most of the total ore consumed in Ontario.

The all-time record tonnage of monthly vessel loadings was reached in August at 13,976,770 gross tons, and the highest weekly tonnage of 3,258,328 tons was loaded in the seven days ending 7 a. m., Monday, August 23.

In addition to the handicaps previously referred to, mines and transportation agencies, were continuously beset with labor shortage occasioned by losses in personnel to the armed forces and to other industries. The over-all manpower situation in the entire district was continuously under scrutiny by the operators, who of course, cooperated with the War Manpower Commission and Selective Service in scheduling the necessary release of men to the armed services. But at times there was a question in the minds of some as to whether iron ore or soldiers were to be the most important output of the mines. The manpower shortage has been partly met by employment of any available inexperienced men, by lowering the usual physical standards for employment in the industry, and by employing women wherever these could be utilized. At mid-season, the mining industry of the United States ranges only—not including transportation beyond the mines—employed more than 24,000 persons and needed many additional. During school vacation, many students and teachers were utilized. Women largely replaced men lost to offices and to chemical laboratories; and to serve the latter, special training courses in ore analysis were provided by advanced schools in the district having the necessary facilities. The lake shipping employed about 15,000 men in the ore trade, and also had its problems in maintaining adequate crews. During the year essentially all the mines were completely

unionized under labor contracts with the C. I. O.—United Steel Workers of America.

The mine operators who sell their ore, being caught in the squeeze between the OPA price freeze on ore at the 1941 sales levels and the rising costs of labor and materials, early in the season petitioned the OPA for some upward revision of prices. Despite a few individual adjustments earlier in the season, no general adjustment for the industry was announced until near the end of the year when an order was issued, covering all 1943 ore sales and those thereafter, permitting prices frozen at levels below the 1941 base (e.g. $4.45 for 51.5 percent Fe Mesaba non-bessemer, etc.), to move up only to the base prices. The permissible increases, which are relatively small, vary with individual producers according to their sales contracts.

Rapid exhaustion of mines, inadequate labor to do the vast production job in hand, declining profits as rising costs approach ceiling prices, and increasing tax burdens, all combine to make iron ore producers realize that the great war task of this industry is no desirable antidote to the stagnation of depression, and that despite the appearance of local prosperity brought about by great activity in the mining communities, there are ahead post-war days of reckoning with problems equally trying, if not more so, than those of this war period.

The marked depletion of commercial-grade ores to meet war requirements has focused the attention of most operating companies during the past two years on the problem they had long known must be faced eventually, i.e., the production of suitable blast furnace feed from the abundant low-grade iron bearing rock of the several Lake Superior ranges—in particular the Mesaba. Although considerable research work has been done in past years bearing directly on this problem, at least four of the operating companies either now are at work or are soon to undertake extensive research programs on it, with modern, well equipped laboratory facilities, where current plant-control work and testing of equipment also can be done. In addition to the continuous research at the Minnesota Mines Experiment Station on beneficiation of all types of Lake Superior iron ores, the Station has recently completed tests on a new nodulizing furnace reported to be promising. An important cooperative research program on this problem of low-grade beneficiation was launched during 1943 at Battelle Institute (Columbus, Ohio), with the support of at least 12 of the principal operating companies including several engaged in their own research projects. The initial assigned task is that of developing a method for economically concentrating the siliceous hematite-bearing iron formation in which the iron oxide is so finely divided as to require very fine grinding for separation, the concentrate then requiring sintering or agglomeration. The magnetic oxide ores, so abundant in the eastern Mesaba area, present much lesser technical difficulties in separation, although most of them are very hard and expensive to reduce in size. Some of these lean ores are mixtures of magnetic and non-magnetic oxides, and hence present added problems in separation. Further attention has been directed to the search for, and acquisition of, reserves of ores most amenable to concentration. Special work on beneficiation of the lean magnetite ores in the Black River Falls area of central Wisconsin was carried on by the company which controls the deposits. In the further search for commercial grade ores in the Lake Superior district, the United States Bureau of Mines has been carrying on extensive surface sampling operations on the western Gogebic range—in Wisconsin; also the United States Geological Survey had a party working all season on important geologic studies in the Iron River district which it is hoped, may yield results of value to the industry in its further explorations thereabout.

Feeding train onto dump in Newport mine, of Pickands, Mather & Co.

REVIEW and OUTLOOK for MINING

In view of the extraction of nearly 260,000,000 gross tons of ore from United States Lake Superior mines in the past three years, and of numerous expressions of apprehension that our country may find its principal ready iron ore reserves largely exhausted with the war, it may be pertinent to note that experience still shows that net depletion of reserves, as a whole, each year is substantially less than the amount of the tonnage mined, because additional reserves are revealed by current exploration and development; and to note also that the present activities of the major operating companies indicate that they have no intention of "closing up shop," if they can help it, when the higher grade Lake Superior ores are exhausted. These companies evidently expect to be prepared—when need be—to supply the lower lakes furnaces for the long future with high-grade, suitable concentrate from the practically limitless resources of low-grade ore in the iron formations of the Lake Superior district. It is unthinkable, to anyone who realizes how vital to the country is its supply of basic raw materials, that the iron and steel industry should ever be allowed to become largely dependent on over-seas imports of iron ore, no matter how large, high grade or otherwise attractive such ore supplies may appear to be.

Recent Developments on the Ranges

In the Minnesota open pit operations, larger trucks and truck-trailer units—of 25 ton capacity compared to the usual 15 ton loads—were put into service at some properties and even larger units are to be used at some operations next season. New belt conveyor installations at a number of the pits were put into operation in 1943, and additional installations are contemplated for the coming season. The longest single conveyor now on the Mesaba is a 1,750 ft. belt of 30-in. width, with speed of 500 ft. per minute delivering 1,000 gross tons of crude ore per hour.

At least two new ore washing plants were in operation during the year, one of which is portable, two new hi-density separation plants, and a new ore-drying plant—the first on the Mesaba range in many years. The hi-density plants are very successful in concentration of coarser sizes, but the recovery of fines must be done by other means. Considerable research is being done on this problem, with new developments reported to be more

promising than methods heretofore used. Figures as to the total tonnages of beneficiated ore produced in 1943 are not yet available, but are expected to be about 20 percent of the total output, as was the case in 1942. Production of bog limonite from southeastern Minnesota, started in 1942, continued in 1943 with shipments of 220,000 tons, which is included in the Lake Superior figures. Further production from this property is not presently anticipated, although the ore of this type in the area is not exhausted.

A large volume of stripping, together with churn drilling and considerable diamond drilling were done throughout the year. Perhaps the most spectacular open-pit mine undertaking is the great water diversion, lake drainage, and stripping project at the Embarass Lake property in the eastern Mesaba District. Opening of this property, containing some 20,000,000 tons of direct shipping ore, requires pumping out a lake, diversion of drainage, and stripping of much glacial overburden, estimated to cost about $5,500,000 to put it into operation. It is expected to begin shipments by early summer of 1944. Another similar but smaller new operation to come into production in 1944 is at Rabbit Lake on the Cuyuna Range.

In the Michigan-Wisconsin area, where most of the mines are underground, failure of recent discovery and development of reserves to keep pace with the wartime rates of production is apparent. Several of the older mines closed down in 1943 with exhaustion of their ores and others are nearly finished. Sixteen diamond drills have been at work in the state during the year on exploratory work, but normal underground development in existing mines have been impossible because of labor shortage. This problem of under-development, and also of under-maintenance, grows more and more acute, with normal expenditures for such work necessarily being deferred without, however, any reserve account being made possible to take care of them later. Two important new underground mines came into production during the year—the Sherwood in the Iron River District, and the Mather on the Marquette Range. The latter, which is the most spectacular mining project in the upper Peninsula, produced only a small tonnage in 1943 but will contribute substantially in 1944. At these mines are some promising innovations in equipment and practice, including diesel trucks for ore stockpiling, a shaker conveyor underground, drill "jumbos" and electric mucking machines. Some 40 installations of the drill "jumbos"—mounting several drills for rock work—are reported in use throughout the ranges. A 30-in. ventilation bore hole put down 1,000 ft. with cable tools at the Sherwood mine and a 66-in. shot drilled ventilation bore partly completed to about 1,500 ft. at the deeper Cary mine attracted special interest. One new truck-operated open-pit mine — the Book—in the old Crystal Falls District was put into production, and an inclined skipway fed by trucks replaced railroad haulage for removing ore from the deep open-pit of the Plymouth on the Gogebic Range.

Of the charcoal blast furnaces in Michigan, only the one at Newberry remains in operation, the other two having shut down permanently because of exhaustion of wood supplies.

Canada—As yet, the new Helen is the only mine producing iron ore in Canada, near Michipicoten, Ontario. The product is carbonate ore from which is produced a high grade sinter—partly used at the Canadian Soo plant and in part exchanged for United States ores. Shipments of sinter from this operation in 1943 totaled approximately 445,000 gross tons. Development by drilling of a large and important magnetite body within 50 miles of the Soo by the same company has been under way. Also two other mines in the Michipicoten area—one an extensive hematite body and the other a large carbonate body —have been under significant development by large Canadian mining interests, with testing of the ore at a pilot plant preliminary to important future operations.

In the Steep Rock Lake area, west of Port Arthur, Ontario, progress on the large Steep Rock mines enterprise is reported as progressing well ahead of schedule, and substantial production of its high grade ore, including needed open hearth lump, is expected in 1944. Other companies, some of them United States operators, also have carried on exploration in that area. Other exploratory work done in eastern Canada during the year includes drilling of deep magnetites near Hamilton, Ontario, surface work on hematites in the Gunflint District north of Lake Superior. Also a season's work was carried on in northern Labrador (which belongs to Newfoundland) by a large field party of geologists and engineers, equipped with a light drill, etc., and included further mapping and exploratory drilling of the large and important hematite bodies of Lake Superior type discovered there a few years ago.

Other Districts

Eastern—The eastern magnetite mining industry of New York, New Jersey and Pennsylvania now is closely allied to the Lake Superior industry because operators from the latter district are prominently engaged in it, and much of its current and planned output—particularly that of New York—is to supply furnaces otherwise largely dependent on Lake Superior ore; hence this production is providing substantial relief to the burden on Lake Superior mines. Republic Steel Corporation, which acquired the Witherbee-Sherman operations at Mineville, N. Y., in 1938, and the Chateaugay Ore and Iron Company's operations at Lyon Mountain in 1939, is the largest factor in the Adirondack iron ore industry. It has recently added a third large enterprise (a DPC project) at Fisher Hill —near the Mineville properties—embracing reopening of a long idle mine and construction of a large new concentrating mill and a sintering plant, to greatly increase the output by this company in 1944. Recently published data (see *Mining and Metallurgy*— November, 1943) indicate the annual capacity of the Mineville property at full operation as now 1,000,000 gross tons of shipping product (sinter and lump ore), of Chateaugay as nearly 500,000 gross tons of sinter, and of Fisher Hill as ultimately over 1,000,000 tons of sinter. These sintered ores generally run over 68 percent in iron. Reserves are reported to be very large and adequate to insure long life to the operations.

The MacIntyre development, high in the Adirondacks, nearly 40 miles west of Mineville, is a National Lead Company enterprise at an old historic mining property which the company acquired in 1941 and brought into production in 1942. The ore is a mixture of ilmenite and magnetite, said to contain 16 to 20 percent titanium dioxide. A large tonnage of ore has been developed, and the concentrator is reported to have a daily capacity of 6,000 tons of crude ore to produce annually 750,000 tons of magnetite and half as much ilmenite. Mining is by open cut, and the property recently has been producing 1,200 gross tons per day of high-iron magnetite concentrate, along with 600 tons of ilmenite, which is recovered for its titanium content. Some of it has been shipped to eastern furnaces but most of it stockpiled for sintering when the plant now under construction is completed. This magnetite also contains vanadium and constitutes a possible source of that metal, although a satisfactory process to recover it has not as yet been reported.

In Lawrence County—just northwest of the Adirondacks—the M. A. Hanna Company, since 1941, has been developing Clifton Mines, another magnetite property with a long history of various earlier attempts at mining and smelting. Operation began in September, 1942. The first substantial production, in 1943, has been from an open cut, but underground operations also are scheduled for 1944. The project includes a magnetic concentrator of 1,800 gross tons daily and a sintering plant producing a product containing 62.45 percent iron, 4.97 percent silica, .010 percent sulphur, and .021 percent phos.

About 10 miles south of the Clifton operation, Jones and Laughlin has been developing another long-known ore body at Benson Mines, which contains both magnetite and hematite ores. The enterprise is well along and is expected to be a substantial producer beginning early in 1944. It is planned to mine from an open pit for some years but underground eventually. The mill is designed to treat 9,000 gross tons daily of the magnetite ore running from 25 to 30 percent in iron and to produce a 60 to 65 percent iron concentrate which will be sintered before shipment. Originally planned for 400,000 tons annual output, the present plan is for a million tons capacity.

The rigorous winter climate of northern New York, the handicap of continuous and serious shortage of labor, and the problems of obtaining equipment in wartime have all combined to impose upon those who are engaged in creating new mining enterprises in that region tasks worthy of the pioneering tradition of the mining industry.

Expansion of mine capacity and renewal of interest in the old magnetite district of northern New Jersey is a direct result of the war demand for ores to supply eastern furnaces. This region, which has a production record of over 34,000,000 gross tons of ore since about 1680, is, of course, one of the oldest iron-producing regions of this country. Mining is all from underground. The average shipping product now runs about 63 percent iron—about 20 percent being open-hearth lump and the balance sintered concentrate produced from crude ore running as low as 30 percent in iron. Tonnage shipped in 1943 was about 520,000 gross tons, compared to 604,000 in 1942 and a recent peak of 659,000 in 1940. The decline in output is attributed to shortage of skilled labor, whereas substantial increase had been planned for 1943. Alan Wood Steel Company, which has operated the Scrub Oaks and Washington mines, started production from the new McKinley ore body at the Washington mine in October, 1943. This company also expects to start production by early spring at the old Peters mine at kingwood, now being reopened.

Warren Pipe and Foundry Company has been preparing to expand its Mt. Hope mine operation at Wharton through a deep new shaft (Mt. Hope No. 2) to reach a depth of 2,700 ft. and tap the lower parts of its ore bodies. This project is the most ambitious undertaking of the group and is expected to get into production before April of this year. The other principal producer in the state is the Richard mine, at Wharton, of the E. and G. Brooke Iron Company. Other possible new operations in the state include the reopening of the Jugtown Mountain mine and West End mine, near Dover, by West Portal Mines, Inc. All these new projects, when completed and fully manned, will add over a million tons output capacity to this district.

Two other magnetite ore mining projects—one in the old Croton district, near Brewster in southeastern New York, and the other at Boyertown in southeastern Pennsylvania—were both approved by WPB and had been expected to be in operation some-

Iron ore preparation plant of the Clifton Ore Co.

time in 1944 but have been held up.

In Pensylvania, a new mining project near State College, by the Scotia Mining Company, has been under way and is scheduled to begin production about March. It is expected to produce about 400,000 gross tons of brown ore from a surface mining operation, using a sink and float plant to separate the siliceous matter, and yielding a product containing 50 percent iron, 9 percent silica and low in phos.

The only actual production of consequence in 1943 in Pennsylvania was from the Cornwall operation by the Bethlehem Steel Company near Lebanon, a long and consistent producer. The magnetite ore, which runs about 40 percent in iron, is mined by open cut in a deep pit and also from underground, and is concentrated and sintered, producing a high grade product for use mainly at the Bethlehem works. Ore reserves are reported to be very substantial, enough for many years of operation.

In the entire Northeastern district, production of high grade magnetite sinter and concentrate, together with

REVIEW and OUTLOOK for MINING

considerable open hearth lump, is expected to reach about 8 million tons annually from all the mining operations and projects now in operation or under development, when all are complete and adequately manned. Production in 1943 fell short of the anticipated 5.5 million gross tons of shipping product by more than 2.3 million tons, due mainly to the labor shortage. The new projects have been especially handicapped, as they have had to depend mainly on inadequate local help entirely inexperienced in mining. Whether or not any real approach to the contemplated tonnage from this region in 1944 will materialize remains to be seen. Nevertheless, its iron ore mining industry seems firmly established, is in strong hands, and needs to be recognized as a growing factor in the future iron ore supply of this country. The indicated magnetite ore reserves are very large, although the limits are as yet far from known. Various estimates have been made indicating upwards of 600 million tons of mineable magnetite ores and several times that tonnage of titaniferous maghetites. Additional important developments in this region are reasonably to be expected in the coming years.

Southern—Total 1943 iron ore output in the southern district, mostly for consumption in Alabama, is estimated at 8.53 million gross tons, a decline of substantial amount from the 9.21 million tons of 1942. This includes a small tonnage of brown ore and hematite from open cut mines in southeast Missouri shipped to the furnaces at Granite City, Ill.

Two mines in the Birmingham district were shut down in 1943, the Ruffner by Sloss-Sheffield and the Raimund by Republic. The old Spaulding mine was put into production by Republic in July, following rehabilitation of the property in 1937 and experimentation with ore concentration since 1940. This operation (a DPC project) which includes a large new concentrating mill and sintering plant, is expected to produce annually over 400,000 gross tons of concentrates, to be sintered with some pyrite residues, to yield a 50 percent iron product. Woodward Iron Company started production from its new Pyne mine in 1943, the first to be opened by a vertical shaft below the outcrop. This mine will largely replace the company's old "Red Mountain" mine.

The tendency in all the Alabama red ore mines is toward greater mechanization, to get away from selective mining, and to permit extraction of

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1. GEARS AND PINIONS

The most important point in replacing gears and pinions is to see that they mesh properly. A gear will usually wear out about five pinions—a new gear installed with a badly worn pinion will usually ruin the gear—they will not mesh properly.

2. WORMS AND WORM WHEELS

These items must also mesh properly when installing — be well lubricated when in operation.

3. SPROCKETS AND CHAINS

When installing a new sprocket—check the pitch of the chain. Do not use a new sprocket with worn chain or a worn sprocket with new chain.

4. ARMATURE COILS

When rewinding an armature—be sure the core is smooth with no burnt places—no sharp frayed edges which might penetrate the coil. Always use a connection diagram.

5. CUTTER CHAINS AND BITS

After every cut—run the machine to throw off dust; lubricate with No. 52 oil while the chain is still hot. Keep bits sharp—replace lost or worn ones. For smooth running—replace any broken lug with one of the same angle.

6. CONTINUOUS STEEL STRIP RESISTORS

Keep the resistor bolted firmly in place—leads clamped tightly in the terminals. The resistor element is insulated from the plate with vitrous china blocks—the plates are insulated from the frame with micanite. Be sure this insulation is always in good condition.

7. LININGS AND BUSHINGS

Keep well lubricated with proper lubricant. Watch excessive wear—worn linings and bushings throw gears and other parts out of mesh or alignment.

8. COMMUTATOR REFILLS

When a commutator is worn down—replace at once. Refills are furnished baked and finished—banded to mount on shell.

Follow Factory Lubrication Recommendations.

the entire width of ore seam. Careful study is being made of processes for quickly separating the waste rock thus produced and concentrating the siliceous ores which require fine grinding. The sink and float process, in successful use elsewhere for quick scalping of waste material, is being studied for adaptability to this problem. The near-outcrop soft ores and the high-lime ores being largely exhausted, the industry must depend mainly on the large reserves of more siliceous ores for future furnace feed. Total ore reserves, of course, are very large, reported at in excess of 1.5 billion tons of 33 percent to 36 percent iron content, and are second only to the Lake Superior district in over-all importance. However, because of grade and location they constitute no substitute for the latter, although well assuring a long life to the important and growing iron and steel industry of Alabama. The mines, being mostly underground, could not—even if it were desired—expand output to meet any such relative increase in demand as the Lake Superior mines have had to meet in the war period.

In northeastern Texas, where mine operations were expected to get into production in 1943 to supply the new blast furnaces at Houston and Daingerfield, Tex., no actual shipments were made, although the mining equipment (power shovels and trucks) and washing plants have been getting ready for operation to supply the Houston furnace expected to go into blast early in 1944. This furnace, to be operated by Sheffield Steel Co., will require about 365,000 gross tons of Texas ore per year—half to be supplied from the surficial limonites north basin (in Cass, Marion, Morris and Upshur counties) and half from the south basin (Cherokee county), in addition to about 135,000 tons of magnetite ore from Cerro de Mescado in Durango, Mexico, running 63 percent iron and high in phos. The Daingerfield furnace is not expected into blast until sometime later. The mixed beneficiated product to be shipped to Houston from the Texas operations is anticipated to run—by wet analysis—about 46 percent iron, 11 percent silica, alumina from 3 percent to 9 percent, and phos. ranging from about 0.1 percent to 0.3 percent. For the ores from north basis for Daingerfield, much more elaborate beneficiation is planned, including washing, roasting of limonites and of carbonates, and sintering, making products containing 51 percent to 56 percent iron, about 11 percent silica and 0.08 percent phos. It is reported that the small, long-idle ferrophos. furnace at Pembroke, Fla., is to be moved to Rusk, Tex., and converted to the production of charcoal iron. Iron has long been made in northeastern Texas in small furnaces, but none of these has operated since about 1911. Ore reserves scattered over some 90 square miles in both basins have been estimated at 150 to 200 million tons.

Iron ore operations in southeastern Missouri in recent years have been confined to the shallow brown ore deposits in the residual clays and to the limestone sink-hole hematite bodies. During the coming year, the old Iron Mountain mine, with re-equipped concentrating mill, is expected to be reopened by Ozark Ore Company (subsidiary of the M. A. Hanna Company). This operation will add substantially to the ore supply readily available to the furnaces at Granite City, Ill. The mine, which has been well known since first opened in 1845, was last operated in 1930 by the Hanna interests, and was further explored by diamond drilling during 1942. Of the several iron ore mines which long attracted attention to Missouri, this has been the most important producer, with a record of more than 3½ million tons output. The ore, which is dense, hard, specular hematite with more or less magnetite, has been mined by both open pit and underground operations. It occurs in interesting association with igneous rock—the rhyolite poryphyry of the so-called St. Francois Mountains. Most of the ore will be concentrated, to produce a very desirable blast furnace feed of high iron content.

Western—Total 1943 output from mines in the western states—mainly Wyoming, Utah, California and New Mexico—was approximately 2.45 million gross tons, a substantial increase from 1.48 million tons in 1942.

The Sunrise mine in eastern Wyoming, which supplies most of the ore for the Colorado Fuel and Iron Company at Pueblo, is just completing a new shaft to be in use early in 1944. During the past year, therefore, its production has been limited, and some ore for the plant has had to be supplied from the company's properties in Iron County in southwestern Utah, near the mines of Columbia Steel Company. Some ore also was supplied from the Hanover district and from Socorro County in New Mexico. The Wyoming ore is hematite containing (dry) about 55 percent iron and 0.08 percent phos.

Ore from the Iron Mountain district of Utah is supplied mainly to the two Provo blast furnaces of Columbia Steel Company. It is a good grade of hematite, or semi-altered magnetite, containing (dry) about 55 percent in iron. Mining is by open cut. An extensive iron ore drilling campaign was carried out in that district during the past year by Columbia Steel Company, Colorado Fuel and Iron Company and by the United States Bureau of Mines, resulting in developing substantial reserves for the new furnace plant at Geneva, Utah, as well as additional tonnage for Colorado Fuel and Iron Company. At the Geneva Steel Plant (a DPC project) being constructed at a reported cost of about 180 million dollars, the first of three blast furnaces was put into operation on January 2, 1944. The other two are expected to be blown in soon. It will require about two million tons of ore per year for all three blast furnaces.

The Kaiser Company's blast furnace at Fontana, Calif., has been supplied from the beginning of its operation in early January, 1943, with ore from the Vulcan mine at Kelso, Calif., 176 miles from the plant. This ore contains about 51 percent iron, and the available tonnage, estimated at about a million, is expected to supply this furnace until the opening of some of the other available deposits—such as the large ore body at Eagle Mountain in Riverside County.

Conclusion

All who have had a part in the great war effort of the iron ore industry again can feel gratified with another year's results, which, although less than had been anticipated, are such that no shortages of war equipment and supplies can be laid to failure of iron ore supplies for the furnaces.

The present outlook as to iron ore for the ensuing year is uncertain, because of rapid changes in the war situation. But regardless of this uncertainty as to the volume of possible demand for iron and steel during the immediately ensuing months, it appears fairly certain that, until the war is much nearer won than it is now, the over-all requirements of iron and steel, and hence of ore, are not likely to be appreciably diminished. The recently announced government war budget at least confirms this observation. Certainly at present, to plan otherwise or to relax effort would be folly. Thus, it seems reasonable to assume that initially in 1944, iron ore production in the United States as a whole will be directed toward as large a goal as was contemplated early in 1943. With new capacity for iron and steel production in the west and south coming into operation, and notable new iron ore capacity being added in the east, west and south, there seem likely to be some shifts in the relative volumes of ore production of the several principal districts, even though over-all total steel output may not be substantially increased.

Obviously, the whole situation depends principally upon the progress and the fortunes of war. There is no use trying to look far into the future, except to anticipate the maximum difficulties that may be encountered in achieving the maximum production that may be required. After midsummer should be a better time to see

(*Continued on page* 91)

Bauxite, Alumina and Aluminum Ingot

By JAMES L. HEAD

Chief, Raw Minerals Branch,
Aluminum and Magnesium Division

THE year 1943 saw aluminum reach productive capacity goals, and a comfortable stockpile position. The emphasis shifted from production to consumption, with lessening restrictions on use. The primary production for December reached an all-time high and was at an annual rate of over two billion pounds, slightly in excess of the rated annual capacity of all facilities after making adjustments for certain potlines completed but never brought into operation. Notwithstanding this shift in emphasis, a review of the raw materials situation and plant facilities leading up to this record production may be of interest.

Bauxite continued to be the sole source of aluminum. In 1941 and 1942, when planning the great expansion in bauxite mining operations, it had been necessary to provide for the possibility that enemy submarine activity might cut off completely the imports of bauxite from the Guianas on which a large part of the domestic aluminum industry and all the Canadian facilities had previously been dependent. With the cooperation of Metals Reserve Company bauxite production was so stimulated that slightly over six million tons were mined from the Arkansas deposits in 1943. This represented an increase of 156 percent over the previous year and 58.6 percent of the total production from the state from 1899 up to 1942. Peak production which was reached in August was at an annual rate of over eight million tons and 20 operators were active in the field. By this time the submarine situation had improved so that not only was a substantial tonnage being imported into Gulf ports but it seemed reasonably safe to assume that Canadian bauxite requirements would be met by imports. Thus not only had the output from the Arkansas mines reached a figure in excess of current domestic requirements but approximately a year's supply of bauxite in both Government and privately owned stockpiles had been accumulated. Some curtailment was in order to balance production with consumption and avoid further stockpile accumulation. The cut-back was started in October. Requirements of domestic bauxite for 1944 should approximate four and a half million long tons.

Continuing its intensive exploratory drilling campaign, the Bureau of Mines in cooperation with the Geological Survey delimited an extensive new tonnage of bauxite not only in Arkansas, the location of its main effort, but also in the Alabama and Georgia fields. Although much of the new tonnage is not as accessible nor, in general, of as good grade as the majority of the deposits now being exploited, the development, nevertheless, is an important addition to the none-too-abundant domestic reserves. Much drilling was also done by individual operators and the results were important factors in offsetting the drain on the previously known deposits.

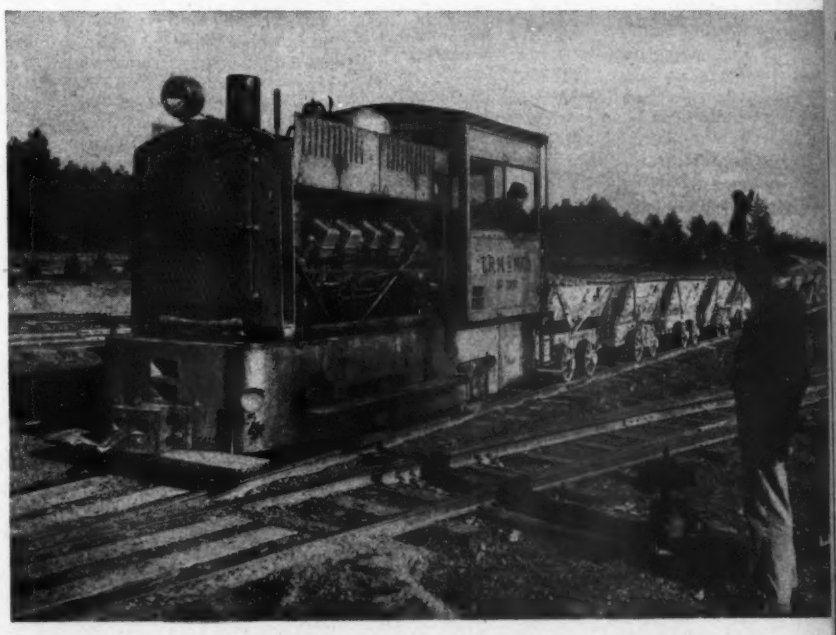
Alumina, the oxide of aluminum, which the industry refers to as "ore" rather than the original bauxite, was produced in five plants, all of which were in production by the end of the year. Peak production was reached in October and attained a rate of five billion pounds annually or slightly in excess of the total rated capacity of all the facilities. Stocks of alumina were now sufficient so that some curtailment was effected at the end of the year. The record production is all the more interesting when it is considered that most of it was obtained from lower grade bauxite than had ever before been used in the Bayer-process plants. This involved problems of additional settling, filtering, and washing equipment and called for the use of greater quantities of soda ash.

Construction and material supply difficulties delayed the completion of the lime-soda-sinter plants which were planned as additions to four of the standard Bayer plants. By the process to be employed in these additions even higher silica bauxite may be treated effectively. The process consists of sintering the red mud tailings from the Bayer plants which contain an appreciable amount of alumina and soda ash with limestone and additional soda. The sinter is ground and leached and the sodium aluminate leach liquor thus recovered is then returned to the standard Bayer precipitation tanks. At the year's end sintering operations had started on a small scale at two of the plants.

The government-owned plant of Kalunite, Inc., at Salt Lake City, Utah, designed to produce alumina from alunite, started operation in September. Its tuning-up period finds the plant having its share of those difficulties which are incident to the expansion of a new process from the pilot plant stage.

Alumina from sources other than

Train of Bauxite ore at the Republic Mining & Mfg. Co., Bauxite, Ark.



bauxite, particularly clay—that will-o'-the-wisp of the industry—received the usual amount of vociferous publicity and political sponsorship. No process, however chimerical, could help but save the aluminum situation in the face of dwindling reserves, etc., etc., etc. Actually, some half dozen proposed processes stood the painstaking scrutiny of the Alumina Subcommittee of the National Academy of Sciences and were recommended as having possibilities for practical application. Construction of three plants each designed to produce approximately 50 tons of alumina daily and each to employ a different process was authorized, one of which was actually under construction at the end of last year. In spite of the improved aluminum situation it is expected that these three plants will be completed. It should be emphasized, however, that these plants are regarded as being largely experimental. If these other materials can be treated successfully they will become insurance factors against possible exhaustion of bauxite reserves in the event of a long war. The authorized plants are those of Ancor Corporation now under construction at Harleyville, S. C., and of the Monolith Portland Midwest Company and the Columbia Metals Corporation to be constructed at Laramie, Wyo., and Salem, Oreg., respectively. The first two plants are to use alkaline processes employing as raw materials clay and limestone at Harleyville and anorthosite and limestone at Laramie. The Salem plant will treat different clays from the Pacific Northwest by an ammonium sulphate process developed by the Chemical Construction Corporation.

Construction of all potlines, as aluminum reduction facilities are known, was finally completed in 1943. At the year's end all of the country's 16 reduction plants were in operation. With the bauxite and alumina programs shifting into high gear, it is not surprising that ingot production by the time-tried Hall process reached such unprecedented proportions. Of the new plants, the three operated by the Reynolds Metals Company and the Olin Corporation employed the Soderberg continuous electrode. Capacity of these Soderberg plants represents about 9 percent of the rated capacity of all potlines. The facilities of the Aluminum Company of America represent about 36 percent of the nation's potential annual capacity, Reynolds represents 7 percent while the remaining 57 percent is concentrated in the nine government-owned plants. The greatly increased demand for the materials employed in the reduction process such as cryolite, acid fluorspar and carbon electrodes presented probably more problems than the production of the metal itself. Labor shortages in certain areas were serious at times and might have been more so had demands for aluminum been further expanded. As it was, three new potlines in critical labor areas on the West Coast were not put into operation.

Coincident with the increase in primary production has been a rapid rise in stocks of secondary or scrap aluminum. Although not alarmingly high at present it is important that as great a percentage as possible of the scrap generated should be absorbed by the aluminum system.

Discussion of aluminum fabricating and fabricated products is not within the scope of this review. However, the picture has changed greatly from early 1943 when all fabricating facilities could not be operated due to metal shortages to the present time when over 1,100 foundries and approximately 130 wrought products fabricators are utilizing the record ingot production. The needs of the aircraft program together with the other requirements of the Army and Navy account for some 80 percent of the fabricated products. On a tonnage basis approximately one-third of the aluminum supply is fabricated as sheet followed in order named by castings, rod and bar and forged shapes, extrusions, tubing and rivets.

The use of aluminum, alumina, bauxite, cryolite and petroleum coke all continued to be restricted under the Conservation Orders of the War Production Board. However, there were some lessening of controls and these will be further eased as rapidly as is consistent with a proper attitude towards the possibilities of a prolonged war and possible up-sets to the aluminum production system.

While all connected with the aluminum industry have reason to feel proud of its achievement, the comfortable production and stocks position existing at the end of the year was brought about largely by the fact that consumption of the metal by the armed services has not approached their estimates of requirements. The aluminum facilities were planned to meet these estimated requirements and actually left such little leeway that at one time in 1943 additional expansion was seriously considered.

It goes without saying that the huge aluminum expansion program planned by the Aluminum and Magnesium Division of the War Production Board and so aptly guided by A. H. Bunker, former Director of that Division and now War Production Board Vice Chairman for Metals and Minerals, could not have been carried to fruition without the whole-hearted cooperation of the industry itself and other government agencies.

Magnesium

1943 production up 275 percent

IN 1943, for the first time since the beginning of the war, the production of magnesium in the United States exceeded the stated requirements. However, the production was still somewhat less than originally estimated by the Aluminum & Magnesium Division of the War Production Board, and the stockpile goal was not quite reached. Whether or not all of the plants will ultimately be required to operate at their full capacity, or perhaps in excess of it, will depend upon the demand. The present indications are that the full productive capacity of all of the plants will not be required.

In general, the capacity of the fabricating facilities has been adequate for the closely restricted uses of the metal. However, additional facilities are being provided to meet the increased demand.

By PERRY D. HELSER

Chief, Magnesium Products Branch
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War Production Board

Production

The production of primary magnesium in the United States in 1943 was approximately 370,000,000 lbs., as compared with 98,000,000 lbs. in 1942. And the potential capacity for the production of magnesium in 1944 is 35 percent greater than that produced in 1943. Of the 15 producing plants, 8 either attained or exceeded their rated capacity during the course of the year, and subsequently 3 additional plants have done likewise. The remaining 4 have encountered some difficulties, due principally to the shortage of labor, delays in construction and unforeseen technical problems. Of the 8 plants using the electrolytic process, 6 of them use the Dow cell.

These include the 4 plants either owned by the Dow Chemical Company, or operated by the Dow Magnesium Corporation, and the 2 plants of Diamond Magnesium Company and International Minerals & Chemical Corporation. All of these use 85 percent magnesium chloride as feed, the various sources being brine, seawater, dolomite, and waste liquors.

Basic Magnesium, Incorporated, which also uses an electrolytic process, employs the Magnesium Elektron Cell, the feed being anhydrous magnesium chloride obtained from magnesite. All of these plants have exceeded their rated capacity. The plant of Mathieson Alkali Works, which is the eighth one using the electrolytic process, employs a cell of new design, the feed being 85 percent magnesium chloride obtained from dolomite and waste liquors. This plant has not yet had an opportunity to demonstrate its capacity.

Of the 6 plants using the ferro-silicon process, 5 of them employ the one developed by Dr. L. M. Pidgeon, whereas the sixth, the Electro Metallurgical Company, is using a process of its own. All use calcined dolomite as feed. Thus far, 3 of the 6 plants have substantially equaled or exceeded their rated capacity. The ferro-silicon process was recommended in 1942 by the National Research Council, as one that could be installed quickly and would require a minimum of electrical power.

The Permanente Metals Corporation employs the carbo-thermic (Hansgirg) process. This process, which proved quite difficult to perfect, is now operating satisfactorily.

The magnesium recovered from secondary sources in 1943 by the 6 secondary smelters, 2 of which have recently been authorized by the War Production Board to operate on the west coast, amounted to approximately 20,000,000 lb., as compared with 8,000,000 lb. in 1942. Most of the secondary ingot produced, was absorbed in the production of incendiary bomb alloy, and for alloying with aluminum. These smelters, in addition to performing their normal function of melting magnesium scrap into secondary ingot, also produced quite a large amount of incendiary bomb alloy from primary ingot, for which the magnesium producers did not have sufficient capacity.

Requirements

The requirements for magnesium in 1943 were 90 percent greater than in 1942. May, 1943, was the first month in which the production of magnesium exceeded the demand. The Armed Services were then requested to determine the additional amount of magnesium they would absorb, if its use were unrestricted. The requirements for 1944 received thus far, exceeded those for 1943 by 50 percent. Included in these are some new uses which look promising and are being investigated.

The use of magnesium and magnesium products has been confined almost entirely to direct military applications. Approximately 30 percent of the magnesium consumed in 1943 was for aircraft, principally in the form of castings, and to a much less extent, in the form of wrought products including sheet, extrusions, and forgings. The magnesium required for the manufacture of incendiary bombs, which are made by the permanent mold process, amounted to approximately 25 percent of the total consumption. The magnesium for grinding into powder for tracer ammunition and flares amounted to approximately 5 percent for the Army and 2 percent for the Navy. Other essential uses, which consisted principally of the magnesium required for alloying with aluminum, amounted to approximately 8 percent of the consumption. And finally, approximately 30 percent of the magnesium shipped has been supplied through Lend-Lease to our Allies principally in the forms of virgin and alloy ingot.

Fabricating Facilities

The capacity of the fabricating facilities available during 1943 was sufficient to meet the minimum demands of the aircraft program. However, it is quite possible that more magnesium could have been used for new uses, if more fabricating facilities had been available. Additional facilities are now being provided to meet the increased requirements and to give a satisfactory margin of safety.

The principal type of magnesium casting used in aircraft is that made by the sand casting process. Fifty-five foundries were in operation at the end of 1943, and 7 additional plants have been approved and are expected to be in production within the near future. Many of these foundries were converted from the production of gray iron castings, and have been quite successful in learning the new technique required for the manufacture of magnesium sand castings.

Magnesium in the form of permanent mold castings is also used quite widely in aircraft, and it is expected they will be produced in 10 foundries in 1944. And finally, 21 plants are expected to supply the die castings required for use in the aircraft industry, and by the other Claimant Agencies during 1944.

The capacity for the production of magnesium extrusions in the form of rolling slabs, rod, bar, tubing, and shapes, is confined to four plants, and will be increased approximately 100 percent between January and June of this year. This will provide a capacity in excess of the peak demand for present and planned usage, but it may prove to be insufficient if some of the new uses being investigated become firm requirements.

There are also 4 fabricators of magnesium sheet, strip, and plate, and the capacity will be increased approximately 100 percent between January and May of this year. Here again, the capacity thus provided, will be considerably in excess of that required for present and planned usage, but may be insufficient if some of the promising possibilities become realities.

The capacity for the production of magnesium forgings, which is confined to 3 plants, is expected to increase 50 percent from January to April of this year. This capacity is thought to be sufficient to provide not only for the requirements based on present and planned usage, but also for the additional possibilities.

The War Metallurgy Committee of the National Academy of Sciences has been very helpful in solving some of the difficult production and fabrication problems. Furthermore, this committee is directing the work on a group of important research projects on magnesium, including "Properties & Heat Treatment of Magnesium Alloys"; "Fatigue Properties of Magnesium Alloys & Structures"; "Formability of Magnesium Alloy Sheet"; "Physical & Stress Corrosion Properties of Magnesium Alloy Sheet"; "Deformation Characteristics of Magnesium Alloys"; "Correlation of Available Information on the Production & Properties of Magnesium Alloy Castings & Forgings"; "Fluoroscopic Methods of Inspection of Metallic Materials"; and "An Investigation of Cast Magnesium Alloys and of the Existing Foundry Techniques & Practices." The work on these projects is being done in suitably equipped laboratories of universities and research institutions under the direction of well qualified men.

REVIEW and OUTLOOK for MINING

The Versatility and Prestige of Silver

Its new war and industrial importance results in unprecedented demand reducing U. S. stocks. Position advances in coming stabilization of world currencies.

By HON. PAT McCARRAN
U. S. Senator from Nevada

IN THE November issue of the MINING CONGRESS JOURNAL there appeared an article entitled, "Silver—A Metal of Growing Importance," in which was portrayed an optimistic picture as to the future of silver. This article pointed out that many of the varied war industrial uses of silver would be extended into the post-war period and that silver will always be a commodity indispensable to a large number of vital industries.

Silver is as inseparable from our present civilization as are iron, aluminum, copper, lead, zinc, and tin. Gold may be withdrawn from circulation rather completely without seriously handicapping industrial production; however, if all silver were placed in storage it would prove to be a serious handicap throughout the whole world.

Before Pearl Harbor and especially since we entered the war an unprecedented industrial demand for this precious metal has developed, 69,000,000 ounces being consumed in 1942. That is in addition to the 46,000,000 ounces consumed in 1942 in the manufacture of silverware, jewelry, photographic material and other civilian articles. 81,250,000 ounces were consumed in 1943 for war purposes alone and 43,750,000 ounces in the arts and other civilian lines. It is authoritatively estimated that from 85 to 90 million ounces of silver will be consumed in war industry alone during 1944.

Silver and silver alloys are the most desirable and durable high-temperature soldering and brazing materials used. Another metallurgical characteristic of silver is its complete lack of a tendency to combine with unalloyed steels. This property together with the high heat conductivity and plasticity of silver has led to its application as most efficient engine-bearing material. The heat created is carried away much faster, thus lowering the temperature of the bearing and adding to its lifetime.

Silver is the best conducting material for heat and electricity that has been found. In the electrical industry silver is used for contacts in layers, inserts and buttons, only the contact areas consisting of silver. It is also used in telephone and telegraph systems, railway signaling devices, washing machines, refrigerators and air conditioning units.

Another outstanding physical quality of silver is its reflectivity of light from the violet to the far infrared region of the spectrum. Its utilization for the backing of mirrors and thermos bottles is world-wide.

Increasing Uses in Chemistry

Silver is a remarkable corrosion protective because of its resistance to alkalies, organic acids, and certain mineral acids. These qualities have led to a wide use of silver in the chemical industry as a lining for equipment, such as stills, condensers, tanks, piping, heating coils, and reaction vessels, even when tin was readily available. The ability of silver to make strong, corrosion-resistant joints has led to wide use in marine and navy piping, high pressure boilers, transformers, busbar assemblies, and oil floats. The addition of silver in small concentrations to the stainless steels has proven to increase the resistivity of the steels against attacks by brine and seawater. The importance of this application is considerable in view of the desirability of the use of stainless steels for marine purposes.

The photosensitivity of silver salts is the basis upon which the photographic industry has been built. As only silver, in form of its halides, can serve for this process, it is no exaggeration to state that this metal is for this purpose truly indispensable!

A property of silver which appears to bear great promise in the future is its effect upon the living organism. This germicidal power of silver has been realized in the past decade in Europe to a much larger extent than in this country. It has led there to the development of plants for the treatment of water supplies, sanitation of swimming pools, and water sterilization in the wine, beer, vinegar and soft drink industries. It should be expected that similar developments will take place in this country. One application of silver as a germicide requires the introduction of silver ions into the liquid to be treated. This can be accomplished by electrolysis or by the insertion of activated carriers into the liquid which emit silver ions at the rate and for the time required. An improvement over this process is one in which an instantaneous germicidal effect is obtained by filtering water through a thin layer of material activated by special silver compounds. The two principal advantages of sterilization by silver are the freedom from off-tastes and odors and the germicidal action which the non-volatile silver ions provide as long as they remain in solution. Swimming pool water so treated inhibits algae growth and is not irritating to the mucous membrane.

Some silver compounds have demonstrated therapeutic value, and recent research developments seem to indicate advantages of certain silver containing materials which may be useful as coatings to be applied to surfaces on which it is important to inhibit bacterial growth. An example of this latter would be coated wrappings for certain phases of the food industry. Another unique property of silver made possible the recent development of a process to render sea water potable.

Laboratory experiments are now in their final stage, out of which will emerge new uses and increased demand for the white metal. The combined consumption of silver in these new uses will probably amount to upwards of 30,000,000 ounces a year. In this connection it is interesting to note that an Indianapolis firm specializing in the production of nonferrous alloys used in engine bearings lays great stress on silver's value in automotive and aviation engine performance, (*Time*, Jan. 3, 1944). They state that every warplane engine relies on silver for all engine reduction gear and supercharger bearings, and that approximately 25 percent of the world's production of silver today is going into engine bearings.

Sensational Demand for War

The Daily Statement of the United States Treasury of February 15, 1944, reveals the fact that 902,622,278.8 ounces of Treasury "free" silver were held by Government agencies for non-consumptive uses in war industrial plants. This silver has been leased for war uses to serve as a substitute

for copper, and will be returned in kind shortly after the cessation of hostilities. In this connection it is interesting to note that 697,210,972.5 ounces of the silver in that category were transferred to the Defense Plant Corporation for use as bus-bars, principally in war plants producing aluminum and magnesium. Within the past few months 205,411,306.3 ounces of Treasury "free" silver have been transferred to another war agency for a new secret use in connection with the war program. Thus we find that the progress of silver as a war metal is nothing less than sensational.

Silver production of the United States for the calendar year 1943 was 41,372,854 ounces. This is 23.5 percent less than the 1942 output of 54,090,765 ounces. This decline in silver production in the United States has been due partly to shortage of manpower and partly to the closing of gold mines which produced some silver. Canada's production was down 16 percent, Peru's output was unchanged at 16,000,000 * ounces, while Mexico's production was estimated to be 87,000,000 * ounces, an 8 percent increase over the 80,700,000 * in 1942. There was also a very substantial decline in imports in 1943 due in part to lack of transportation and labor difficulties, but principally to increased coinage demand in Mexico and other foreign countries which export silver to the United States, the principal contributors being Mexico, Canada, and Peru.

Government Holdings Decline

For the first year since the start of the silver purchase program in 1934, holdings of silver by the United States Government showed a decline. No foreign silver was purchased by the Government in 1943, and acquisitions of newly mined domestic silver amounted to only 5,400,000 ounces. Handy & Harman have estimated that there was a decrease of more than 80,000,000 ounces in the Treasury's silver holdings, most of which was lend-leased to Britain and other United Nations.

Last year the United States used more silver for domestic coinage than in any prior year. For the first 11 months of 1943 such consumption amounted to 95,818,000 ounces, including that in the new "silver" nickels. In addition the United States mints in that period received 12,429,000 ounces of silver for the purpose of foreign coinage.

At the end of 1943, the silver dollars in circulation had increased to $91,581,217, the subsidiary coinage circulation was $671,231,889, and the total silver certificate circulation was $1,564,843,253. These items amount to 11.4 percent of the total money in circulation ($20,439,025,030), which, other than silver money, consists of Gold Certificates ($55,218,979), Treasury Notes of 1890 ($1,154,262), Minor Coin ($253,548,280), United States Notes ($318,122,169), Federal Reserve Notes ($16,730,626,613), Federal Reserve Bank Notes ($623,711,541), and National Bank Notes ($128,986,827). On May 31, 1934, the total amount of silver dollars, subsidiary coinage, and silver certificates in circulation amounted to 13.2 percent of the total of all money in circulation at that time, which was just prior to the passage of the Silver Purchase Act of 1934.

The Act of July 12, 1943, authorized the President, through the Secretary of the Treasury, upon the recommendation of the chairman of the War Production Board, to sell at 71.11¢ an ounce for war uses and civilian needs Treasury stocks of silver not required for redemption of outstanding silver certificates, and to lease to war plants monetized bullion for non-consumptive uses for a period not to exceed five years. This act will expire December 31, 1944.

Under this Act the Treasury has received allocations by the War Production Board for the sale of 26,445,900 fine ounces of "free" silver. Under these allocations the Treasury has delivered, to the end of November, 17,218,466 fine ounces of silver.

In addition, some 40 million fine ounces of silver have been delivered from the "free" silver in the Treasury to foreign governments under Lend-Lease arrangements. Almost 50 percent of this amount was delivered to India.

On July 29, 1943, the War Production Board revised its regulations covering the distribution of silver and stated the specific uses which might be made of Treasury silver, foreign silver, and domestically mined silver. Treasury silver may be used in the manufacture of engine bearings, brazing alloys, solder, and official military insignia; foreign silver may be used in the manufacture of medicines and health supplies, electrical contacts and other miscellaneous products; and domestically mined silver may be used (upon the basis of 50 percent of 1941 or 1942 consumption) in the manufacture of such articles as silverware and jewelry.

There is a steadily growing tolerance on the part of economists and bankers toward the rehabilitation of silver as legal tender money throughout the world.

In ancient, medieval, and modern times, silver has ranked with gold as the measure of monetary value. It is chiefly international political manipulation within the last 50 years which caused silver to gradually lose its ranking as a monetary standard.

* Handy and Harman Annual Review, 1943.
† The Monetary Standards Inquiry, October, 1943.

REVIEW and OUTLOOK for MINING

The nations of the earth have always preferred "hard money," and silver has been preferred to gold by the masses.

The Mexican Bankers Association recently published their views as to what measures should be taken to secure for silver a definite role in any program of economic recuperation that may be adopted at the close of the war. Mexican official quarters state that statistics reveal that silver now discharges monetary functions in many countries and that it is therefore clear in any organization which is finally established that the function of silver will be recognized, thus guaranteeing its international use. They state, "that the importance of silver does not depend simply on the part it plays as merchandise. Something more potent is involved, and this 'something' is that the metal in question constitutes the basis of the daily transactions affecting more than a thousand millions of the inhabitants of our globe. And these daily transactions, although they concern only individuals of limited economic means, add up to an important total in the world markets by reason of the vast number of people involved."

The specific proposals of the Mexican Bankers Association were:

1. To recommend to all the central Banks of America the building up of their reserves in gold and silver, with the proportionate values of 75 percent and 25 percent, respectively;

2. That to this end, they should institute purchases of silver at prices equivalent in their own national currencies to that paid by the American Treasury.

3. That the valuation of those reserve metals shall be made at the equivalent per ounce, in national currency, of $35.00 for gold and $1.29 for silver.

Economists Discuss Monetary Silver

Most of the recent discussion of monetary stabilization has revolved about the international gold standard, on the one hand, and exchange clearing through an international fund on the other.

Dr. Frank D. Graham, Professor of Economics at Princeton University, offers a third suggestion in his article entitled "Fundamentals of International Monetary Policy." † This plan, aimed at substantially unchanging price levels in all countries, with

fixity of exchange rates, involves the readiness of some international authority, or perhaps merely the central bank of some important country, to buy and, after accumulating a reserve, to sell—freely at fixed prices and in indefinite quantities—warehouse receipts covering composite units of standard, storeable commodities. The system could be inaugurated without the slightest disturbance to existing, or traditional, monetary arrangements. All of the present types of money and bank credit could be maintained along with the free purchases of gold at the established price.

Professor Graham states that, "There are certain countries in which silver is still favored as the monetary material and it is desirable that such countries have the opportunity to restore, or retain, a silver standard without thereby injecting a disturbing element into international monetary relationships. The best means to this end would be for the United States Treasury to offer to sell silver, freely, at the same price at which it is prepared freely to buy it." The Treasury has kept stable the dollar price of silver, through the purchase of all the silver offered to it at a designated quotation. He further states that, "because the Treasury's stock is enormous, the dollar value of silver could be maintained indefinitely at any designated level (that is to say that its price, in dollars, could be permanently stabilized) through the offer by the Treasury to sell the metal at the same price at which it stands ready to purchase it. The exchange value of the currencies of silver-standard countries would thereby be fixed vis-a-vis the dollar as well as against all other currencies linked with the dollar through gold or in any other manner. The optional right of redemption in silver, rather than in gold or commodity units, could then be given to any holder of dollars; and silver could be used, just as gold, to make international payments to the United States, or to any country maintaining stable exchange rates against the dollar, at an unchanging rate per ounce of the white metal. Silver would then be interchangeable with gold at a fixed weight ratio."

"Under this system," Professor Graham continues, "there could be no appreciable variation in the price level of the goods in the composite, just as, under the traditional gold standard, there could be no appreciable variation in the price of gold. A given amount of gold or silver would always be interchangeable with the composite of goods in the commodity unit. Any country desiring to maintain a stable price level, would resort quite simply to the gold or silver standard."

Professor Graham concludes with the following proposition: "The adoption in any important country of the policy of commodity reserves, along with the restoration of the free purchase and sale of gold and silver at a fixed price, would operate to stabilize price levels and the commodity value of gold and silver both in the country of adoption and in all gold and silver standard countries. It would thus furnish the basis for fixed exchange rates between their currencies."

Dr. Elgin Groseclose, a noted economist, in his recent article on "Near Eastern Post-War Monetary Standards," ‡ expresses the opinion that only the hardest of "hard white money," silver, is suitable for daily use by the people of the Near East. He recommends for the countries of the Near East—"a return to hard white money, freely circulating at its commodity value, enhanced by the confidence in its quality lent by the mint mark, and abandonment of all forms of paper currency, managed currency, or stabilized ratios, and eschewment of efforts to link their currencies to a world standard. While silver coin has practically disappeared from circulation, fair reserves of the metal are to be found locked in the vaults of many of the treasuries and central banks of these countries, and the return to the standard would draw more from existing hoards. Silver is a metal which is familiar to even the poorest; it is sufficiently cheap that a workman can be paid his day's wage in a coin of silver large enough not to be lost in the seams of his clothing, yet sufficiently valuable to be treasured and give him a sense of proprietorship * * *."

Mr. Dickson H. Leavens, in his discussion of "Far Eastern Post-War Monetary Standards," § concurs in the fact that the Near East and the Far East are, historically and traditionally, a hard money territory. The masses are suspicious of paper money —they prefer metallic money, and that of a high purity of content.

The Far East was the last stronghold of the silver standard and even after that metal had been everywhere abandoned as standard of value, it is still in demand in India as a store of value.

Mr. Leavens states that, "China was the last country to abandon the silver standard and had an experience of some 60 years with the fluctuation price of the white metal. She underwent some bad effects from the great rise in the price of silver from 1915 to 1920 and from the great decline from 1927 to 1932. On the whole, however, these changes in the price of silver served to adjust China's price level to world commodity prices and saved her from the extremes of inflation suffered by the rest of the world in the former period and from the extremes of deflation in the latter.

"China's post-war currency problems are complicated by the present inflation," he continues. "There is still a considerable amount of monetary silver left in China, * * * perhaps 500,000,000 ounces as compared with a peak of 1,700,000,000 ounces in 1933. This is scattered in large and small hoards among the people, and is clandestinely used in some transactions, especially in the purchase of land. It is quite possible that, if the value of banknotes utterly breaks down, this silver will come out of hiding and provide a temporary currency. Similar things have happened when local and regional currencies in China have depreciated to the vanishing point at various times in the last thirty years. This phenomenon might make the path of least resistance seem to be the reversion to a silver basis."

Silver "Spearhead" Currency

During 1943 there appeared in circulation in the African and European theatres of war a new special paper currency which attracted considerable attention in financial circles.

The first of these appeared during the invasion of North Africa and is what the Government calls "spearhead" currency. One of the principal uses of "spearhead" currency has been the payment of United States troops. It consists of United States silver certificates which differ from those in use at home only in the color of the seal, which on "spearhead" currency is yellow. This distinguishing mark was used on "spearhead" currency partly for security reasons to permit the isolation of the currency if it fell into enemy hands, partly to prevent the influx into the area of dollar currency already in the hands of the enemy, and partly to facilitate its entry into the United States by freeing it from present restrictions on ordinary United States currency. Yellow seal certificates are part of the United States currency stock and are included in Treasury statistics of silver certificates outstanding. They are redeemable in silver upon presentation in the United States in the same manner as the silver certificates bearing a blue seal.

The yellow seal silver certificates consist primarily of new currency issued to replace worn certificates bearing blue seal. When the Army indicates a need for a certain amount of "spearhead" currency, the Treasury replaces that amount of worn blue seal certificates with new ones printed with yellow seals. Instead of issuing them through the Federal Reserve banks, the Treasurer issues them directly by delivering them to

‡ The Monetary Standards Inquiry, December, 1943.

§ The Monetary Standards Inquiry, December, 1943.

the Army in return for checks drawn against appropriations made by Congress. The Army then transports them to areas where they are needed. This currency is withdrawn from circulation as quickly as the military situation will allow. The yellow seal certificates are to be replaced by blue seal certificates for domestic circulation. The yellow seal dollars used during the early stages of the North African operation were withdrawn from circulation as adequate stocks of local currency became available. Nearly all the yellow seal dollars used in that area are now in the hands of the United States Army authorities.

"Occupation" currency is the second kind of invasion currency. This is represented by the occupation lire, first used by our forces during the invasion of Sicily and later introduced into Italy proper. They are intended to supplement, and if absolutely necessary, substitute for the Italian paper currency. They are unlimited legal tender in the invaded areas, but they are not part of the United States' monetary stock. The "occupation" currency is printed by the Bureau of Engraving and Printing for the Allied Military Government.

In the other theatres of war our troops have used either American currency or some local currency. In the South Pacific, for example, dollars, Australian pounds, and New Caledonian francs are in use, and in the United Kingdom our troops are paid in sterling.

Stabilizing World Currencies

Recently published criticisms of British economists and bankers make it apparent that the chief objections to the United States Treasury Stabilization Fund Plan are that it is too rigid; on the contrary, American economists and bankers regard the British plan as too flexible. It is, of course, possible to reach a compromise, but doubtful if any acceptable plan can be agreed upon and put into operation, at least, before a partial restoration of world trade has taken place. And it is not likely that the resumption of an orderly world trade can be achieved before the repatriation of large masses of European peoples and their political and civil rehabilitation shall have been accomplished. These readjustments are so fundamentally important and their scope of such magnitude as to require a considerable period of time in which to make world economic recovery possible.

Because of the fact that the United States has enjoyed and will continue to enjoy a large export balance of trade and England will continue to struggle against an inevitable import trade balance, the task of reconciling these diametrically different trade positions offers one of the most puzzling problems confronting the world today. Therefore, conflicting interest must necessarily enter the picture. England will strive to import raw materials from countries that have low-valued currencies in terms of the pound sterling and to export their processed goods to countries whose currencies are exchanged in higher values. As the advantage is with the exporting country whose currency is maintained at a low exchange value, it will be impossible in the post-war period to adjust currency exchange values in a manner that will be mutually beneficial to the United States and England.

During the period of transition from war to peace, currency orderliness must be restored before any substantial step toward stabilization can be effected. In view of the unprecedented dislocation of commercial activity within the various belligerent and occupied countries of the world, together with the unavailability of sufficient gold and silver to support their currencies, much work must be done preliminary to the establishment of currency exchange values on a sound basis. In the premises how could a World Stabilization Fund be expected to function equitably and smoothly immediately following the cessation of hostilities?

In restoring the normal functioning of currency systems it must be realized that gold and silver reserves of the conquered as well as the satellite countries have been confiscated, and in their stead worthless paper money has been circulated. It is quite probable that 75 percent of the silver coins and bullion of those countries have gone into munitions and implements of war. This together with the shortage of money metals

(*Continued on page* 102)

U. S. Treasury, Washington, D. C.

Vindicator and Golden Cycle mine dumps in Cripple Creek District,

Gold Mining Hard Hit

With operations suspended by government edict, the industry finds itself between the "devil and the deep blue sea," but looks confidently to a bright future.

By MERRILL E. SHOUP
President
Golden Cycle Corp.

THE GOLD mining industry of the United States and Alaska climaxed the blackest two-year period the industry has weathered since the foundation of our nation. At the early date this article is written it is impossible to secure final figures as to the production of gold in 1943 compared with 1942, but from the best sources now available it is safe to assume that it will be down at least 25 percent.

World War II Hits the Industry

Commencing the end of 1941 after Pearl Harbor and continuing throughout the entire year of 1942 one obstacle after another plagued gold miners. It was apparent early in 1942 that the nation needed men badly, both for service in our armed forces and to work in defense plants. Gold miners swarmed out of the camps by hundreds to go into the armed services and to take better defense plant jobs. The inability of the gold mining industry to meet the extremely high wages paid by shipyards and defense plants caused a further steady exodus of miners, and the increasing difficulty to secure supplies needed for mining took an added toll.

Limitation Order L-208

These difficulties reached their climax when the War Production Board, on October 8, 1942, issued Order L-208 which, in substance, suspended all "non-essential" gold mining in this country and Alaska for the duration of the war. This Limitation Order marked the first time in American History that gold miners had been denied by government edict the right to mine gold.

The War Production Board, in issuing Order L-208, announced the following reasons for its decisions:

(a) Copper, lead, zinc and other strategic metals were badly needed for the war effort, and to immediately increase production it was necessary to secure thousands of additional miners.

(b) Closing the gold mines would force gold miners to transfer to strategic mines.

(c) The order was purely a manpower saving measure and the War Production Board and its advisory economists confidently expected that several thousand gold miners would immediately transfer from gold to metal mines.

(d) Materials and supplies used in gold mining could be better utilized in other essential war industries.

Representatives of the gold mining industry presented, at a series of meetings held with Government officials, facts, figures and arguments to show that the leaders of the industry did not believe that Order L-208 would secure results expected by the War Production Board, but the order went into effect.

Gold Mines Turn to the War Effort

Order L-208 contained the right of appeal under certain conditions. Many

which furnish bulk of gold ore now handled at Golden Cycle mill

gold mines secured extensions with the hope that their properties could be converted directly into the war effort. It was, however, generally speaking a hard task to completely convert a gold mining enterprise entirely into the war effort. This was due chiefly to the peculiarities of the industry. Some operators sold all their machinery and equipment; others used such part as could be used for the production of war products; some gold miners went into mining ventures to try and produce badly needed strategic metals, such as quicksilver, lead and zinc; other gold mines shut down completely and today remain in a standby condition.

In the case of our own mining companies, including The Golden Cycle Corporation, all our energies and resources were as quickly as possible put directly into the war effort. The Golden Cycle Mill, located in Colorado Springs, Colo., converted a large portion of its custom mill to the production of lead and zinc concentrates. At present it is treating 450 tons per day of lead-zinc ores. These ores are shipped to the mill from practically all mining districts of Colorado, including the San Juan, Boulder, Salida, Leadville, Kokomo, Brechenridge and other districts. Zinc concentrates are shipped either to zinc smelters in Texas or Illinois and lead concentrates to the smelter at Leadville.

Our Cripple Creek gold mine machine shops are manufacturing forgings and other war materials which can be produced with the equipment on hand. The power plant owned by The Golden Cycle Corporation, located at the Pikeview Mine north of Colorado Springs, now furnishes standby power to the city of Colorado Springs municipally owned power plant which, in turn, supplies energy to Camp Carson and Peterson Field, Army camps located within a radius of 10 miles of Colorado Springs. A large percentage of our coal production is supplied to these same camps. Other units of our mining enterprise located in Cripple Creek are producing crushed rock for the construction of Army airfields and are furnishing ballast for railroad rights of way.

Effects of L-208

Whether the benefit to the war effort as a result of the gold mine closing order has been commensurate with the dislocation suffered by the gold mining industry, the economic ruin of gold mining communities, the blow to home morale, and other disastrous consequences is subject to debate and in this resume I will make no attempt to express any personal ideas regarding the success or failure of Order L-208. The fact remains, however, that the gold mining industry certainly partially at least, as a result of Order L-208, has received a paralyzing blow which will take years to recover from. There is bound to be physical deterioration of the shutdown gold mine properties, loss of production, and a tremendous financial loss to the operators. It is impossible even to estimate at this time the damage suffered by the gold mining industry as a result of the forced shut down.

It is significant to note that the United States since the start of World War II to date is the only major gold mining country which has forbidden, by government edict, the mining of gold. The production has continued, probably on a restricted basis, in Canada, South Africa, Russia, Australia, Mexico, and all other principal gold mining countries in the world.

Silver Linings Appear in Black Clouds During 1943

Gold miners, since they are perpetual optimists seeking always to find a silver lining in dark clouds, saw some bright spots appear in 1943 which gave great optimism for the future importance of gold. Significant developments during the year point to the fact that the world will return to the gold standard and that the future of gold will be far brighter than its illustrious past. Some of the bright spots are as follows:

Defeat of Germany and Hitler

Germany and her Axis satellites will go down to the most crushing defeat suffered by any nation in modern times. Hitler during the years he has ruled in Germany has become the world's outstanding exponent of the barter system. He and his pseudo-economists, for the chief reason that Germany did not have sufficient gold to use as a monetary base, had built up a theory that there no longer was

any need for gold as a monetary medium and that commerce and trade, not only of a nation, but the entire world could be handled on a barter basis. His theory of the barter system had also probably convinced certain other nations of the world that gold no longer had any value. With the final defeat of Germany, Hitler and all his various ideas regarding the barter system and the uselessness of gold will disappear from the face of the earth with everything else he has advocated.

Despite Hitler's attitude toward gold, history will show that during World War II in every country which Germany invaded her armies headed straight for the capital city where the invading nations' central banks were located in an attempt to seize the gold. His attitude can best be summed up by the quotation "The only man who dispises gold is the man who has none."

Keynes and White Plans

During 1943 two plans in connection with post-war trade and to stabilize world currencies were advocated. The British proposal, known as the Keynes Plan, and the American proposal, known as the White Plan, were widely discussed by financiers, politicians and bankers. While there are certain differences between these plans both advocate the use of gold as a basis for international settlement and other uses. The use of gold under either of the plans does not mean the same gold standard form which existed in prior years, but does mean that the basis will be gold.

Russia's Influence

Soviet Russia's influence when the war is over will be preponderent not only in Europe but also Asia. Her influence will also be felt by England and the United States. During 1943 Soviet Russia's spokesmen have repeatedly declared its faith in gold and the gold standard and on several occasions has gone so far as to state that Russia expects to repay her debts, including lend-lease furnished by the United States, with gold. The tremendous influence which Russia will exercise when the war is over backing her stand in regard to the use of and her faith in gold will help to veto all artificial systems of international currency and trade and will help to insure the return of the civilized world to the gold standard.

Price of Gold Rises

The faith of peoples in the nations of the world in gold and all it stands for has been further frequently demonstrated during the period 1941-1943 by the fact that gold has sold in free markets of the world at premiums ranging as high as from 300 to 400 percent. At one period the price of gold in parts of India rose to more than $68 per oz. During this same period the price of bar gold in various parts of the world had attained prices far in excess of $35 per oz. In uncertain war times such as the world is now passing through peoples turn to those things which represent faith in something real and tangible, and gold is real and tangible. This has been true in every major war or catastrophe of modern times and history has a way of always repeating itself.

Gold — The World's Oldest Medium of Exchange

Gold has been used as a medium of exchange for thousands of years. We read of gold in the Bible beginning as early as the second Chapter of Genesis, V. 11 and 12, we find— ". . . The whole Land of Havilah, where there is Gold—and the Gold of that land is Good." This constitutes the first mention of any material thing in the Bible, and that thing was Gold.

Prior to the unsettled '30s gold had become the common denominator for monetary purposes in use practically throughout the entire civilized world. This was not due to any accidental reason, but to the fact that gold possesses qualities desirable for a monetary medium in a larger measure than any other known commodity. It exists in sufficiently large quantities to meet exchange needs, yet it is not so abundant to lose its desirability. It is so durable that it will not lose its exchange power through decay or deterioration; it can be divided into small units and used in transactions involving small or large amounts; it is homogenous and all parts or units have a uniform value and can be equally divided; it is portable and possesses cognizability; has stability of value so that when contracts are made which involve the future pay-

Cresson mine shops in Cripple Creek District showing gypsy heads processed for the U. S. Navy. Shop is now also working on airplane forgings

Flotation cells, Golden Cycle mill, with reagent mixing equipment on balcony in rear. Treating zinc-lead ore at this time

ment of money both parties can have reasonable assurance that payments made in the future in gold will have the same absolute and relative position at the end of the contract as at the beginning. Our armed forces have used gold coins in various foreign countries since gold is the one universal monetary medium which is recognized everywhere.

The conviction, which has existed for hundreds of years, has grown steadily throughout 1943 that those nations which have gold possess in this medium the power to rule the world, and that nation which has gold can use it and the power it commands to straighten out the chaotic post-war problems which will face us when the war is over.

So, therefore, I cannot help but feel that the gold mining industry enters 1944 with high hopes for an improvement in the entire mining industry and am setting out some of my reasons for this belief. Conditions cannot be any worse in 1944 than they have been in 1943. There is only one direction the gold industry can go. It must get better since it cannot get any worse.

Supply of Critical Metals Easier

There seems to be a reasonable basis for the belief that during 1944 the War Production Board will at least partially modify Order L-208 to permit gold mines to probably mine sufficient ore to pay standby and maintenance costs. The main reasons advanced by the War Production Board in October, 1942, for entering Order L-208 are not now as pressing as at the time the order was entered. Stockpiles of strategic metals such as zinc, copper, etc., have increased. The War Production Board has publicly announced that the supply of many critical metals has reached the point where, barring unforeseen contingencies, it will be ample to take care of the war demand. Materials used in the gold mining industry have become less scarce.

End of War With Germany

Already many older men have been released from the armed service to return to private life. They must be given employment and, while at present defense industries can absorb most of them, this condition will not exist indefinitely and there will in the future be the need to create employment for millions of returning soldiers.

There is every reason to believe the war with Germany will end in 1944. When this event happens additional thousands of men will probably be released from military service and also the end of the war with Germany will bring a decreased demand for much of the heavy type of equipment such as tanks and guns which have been used with such good effect by the Russians in their offensives against the Germans. There will be, insofar as the United States is concerned, a changeover when Germany is defeated to a different type of fighting equipment such as ships, planes, etc., to finish the Japanese war. This will ease not only the manpower but also the material shortage.

Postwar Restoration

Already plans are being made and discussions taking place covering postwar restoration problems. Every postwar restoration discussion involves the question of international exchange, trade and credits. Russia, England and her colonies, and the United States are the three largest producers and users of gold in the world. It is inconceivable that any of these three countries will do away with the use of gold as a basis for the medium of exchange. It makes no real difference what form the use of gold takes as the basis of international trade and exchange and settlements, but the fact remains that the gold owned by the United States, England and her colonies, and Russia will form the keystone of whatever international trade, exchange and credit system is ultimately devised and put into effect.

Postwar Debts and Devaluation

Finally there is the problem of postwar debts not only of the United States but the entire world which must be solved. The combined costs of the war, plus expenditures of the United States back in the '30s, can easily result in a debt the handling of which will place too great a tax burden to be borne out of our post-war current income. It is hard at this time to see how any substantial retirement of our national debt can be made in the next generation, and the argument will surely be advanced that the generation which fought the war should not be expected to pay all the cost of it. History is full of examples of governments which have devaluated their currencies when taxes have become too burdensome for the people to bear.

REVIEW and OUTLOOK for MINING

Foreign governments will have the same debt problem as we do and there is bound to be the temptation to devalue the currency to build up export trade. Any devaluation which takes place either in foreign countries or our own country will almost surely lead to a world-wide devaluation of currencies and an increase in the world price of gold.

During the period 1816 through 1934 the price of gold was fixed at $20.-676565 per oz. The belief still persists in many peoples' minds that it was the proclamation of the President of the United States that raised the price of gold from $20.67 to $35 per oz. This is not the whole story. On August 29, 1933, the selling price of gold was slightly over $30.99. On January 15, 1934, the price was $34.06. From October 25, 1933, the price rose from $31.36 to $34.06, averaging $33.58 for a three months' period. After January 15, 1934, the price advanced to $34.45, as determined by the United States Treasury, and was advanced to $35 by a Proclamation of the President on January 31, 1934.

The real reason for the final advance of the price of gold to $35 per oz. was due to the fact that the world price of gold had risen to this figure and it was necessary, in order for us to retain our gold in the United States, to meet the world price. There is every reason to believe that the same situation will occur in our post-war era.

Trend

The price of gold in modern times has gone steadily upward and from 1258 A. D. to date the trend has been steadily up. The brightest period of gold lies ahead and not behind.

Golden Cycle mill at Colorado Springs, Colo.; showing flotation department for treatment of zinc-lead ore in center background

Antimony Production Ample for Needs

Supply-demand situation eases resulting in removal of allocation control and restrictions on January 1, 1944.

By L. G. MATTHEWS
Assistant Manager
American Smelting & Refining Co.

As A war material, antimony has thus far played a somewhat inconspicuous role in the present conflict, particularly so when compared with the position of relative prominence it occupied during World War I. No doubt the reason for this is to be found in the changes that have taken place in ordnance requirements with the development of modern-day type of warfare. Aerial, tank, and other forms of armored mobile conflict as carried out under present-day conditions, coupled with the tremendous improvements that have been made in both the range and effectiveness of automatic firing mechanisms have all contributed their part in relegating to a position of lesser importance the use of shrapnel which was employed so extensively in the last war and which gave rise to substantially large tonnage requirements for antimony. In the period 1914-1918 for example, the world's production of antimony averaged over 80,000 tons yearly or well over three times the normal peace-time level.

Although antimony appears on the official list of critical and strategic metals, it is classified under Group III of such metals, which status implies that it is available in sufficient supply to serve as a substitute for more critical materials in essential applications. As a matter of fact, although the War Production Board placed antimony under full allocation control in May, 1942, the supply picture by the early part of 1943 had become so comfortable that the control order was modified in March to allow more liberal distribution and use. Again in December the order was further amended effective January 1, 1944, eliminating allocation control and removing all restrictions on use.

South America and Mexico Chief Supply Sources

During 1943, the tonnage available in the United States totaled something like 78,000 tons, comprised of stocks in Government, as well as private hands to the amount of 22,000 tons and imports plus production of 56,000 tons. Government stocks in the form of ore, metal and products accounted for roughly 13,000 tons, with the balance of 9,000 tons in the hands of private industry. The import supply reached a total of 33,000 tons and domestic primary and secondary production amounted to 23,000 tons. It might be said in general, that as far as primary sources of supply are concerned, South America contributed 51 percent and Mexico 35 percent, with the balance of 14 percent being derived from domestic operations.

Against the foregoing picture, consumptive demand called for the supply of approximately 42,000 tons, thus leaving a balance in reserve at the end of the year of 36,000 tons. Included in this reserve is the Government stock pile acquired through the medium of the Metals Reserve Company. While stock-piling operations on antimony tapered off around the middle of the year, somewhat under 2,000 tons of metal and roughly, 13,500 tons of ore were added to the stock pile during the period. At the beginning of 1944, the Government stock pile was reported as standing at 13,000 tons of metal plus nearly 15,000 tons of antimony in ore.

The 42,000-ton demand encountered in 1943 was divided roughly between 24,000 tons of primary antimony and 18,000 tons of secondary material. This consumption of primary antimony comprised, in terms of antimony content, somewhat under 5,000 tons of ore, 9,000 tons of metal and nearly 10,000 tons of oxide. Actual production of metal and oxide during 1943 amounted to 9,850 and 9,750 tons, respectively—the figure for oxide being expressed in terms of metal content.

The chief uses of antimony in 1943 were divided approximately as follows:

For metallic products..... 72.5%
For non-metallic products..... 27.5%

The highlight of the antimony picture for the year was the really substantial amount of antimony that was used in non-metallic form for the flameproofing of textiles and special types of paint. Lesser amounts were used for the production of glass, matches, ammunition primers, and miscellaneous chemicals. An important peace-time non-metallic use of antimony is in the form of oxide as an opacifier in vitreous or so-called porcelain enamels and under normal conditions, quite an appreciable tonnage is employed for such purpose. This use, however, has been practically non-existent since our entry into the war, primarily by reason of the fact that steel for enameling purposes has not been available to industry. The principal uses of antimony in metallic form were in the production of battery plate metal, small arms ammunition, bearing alloys, solder, type metals, cable covering, etc.

Looking ahead for 1944, it seems reasonable to expect some decrease, not only in supply, but demand as well. With a reserve stock of around 36,000 tons available at the beginning of the year, we shall without doubt see a considerable reduction in import supply, principally no doubt, from South America and possibly, too, to a lesser extent from Mexico as well. Domestic production likewise will doubtless be less than it was in 1943, particularly in the case of secondary output, inasmuch as there are already indications pointing to the fact that supplies of secondary antimony are showing signs of decline. Taking these facts into consideration, it would not be surprising to see the available tonnage drop from the 78,000-ton figure for 1943 to something around 65,000 tons in 1944.

On the consumptive side there will, without question, be a considerable curtailment in non-metallic use of antimony, inasmuch as the program calling for its extensive use in flameproofing was pretty well completed by the end of 1943. The indications are, too, that there will doubtless be some decrease in the use of antimony for ammunition purposes. As a result of this curtailment of use in two important war-time requirements, it is not inconceivable that consumptive demand in 1944 may very well run under the 1943 level to the extent of as much as 8,000 tons.

If it can be assumed that the supply picture for 1944 will approximate something like 65,000 tons and consumptive demand reaches a level of around 36,000 tons, this will leave a stock balance available at the end of the year of 29,000 tons or an amount just about equal to the Government stock pile as it stood at the beginning of the year.

Quicksilver Meets All Wartime Requirements

By S. H. WILLISTON
Vice President, Charge of Operations
Horse Heaven Mines, Inc.

SO FAR as the quicksilver industry is concerned, the war is over unless Washington decides that there is to be an additional need for the metal.

The outstanding feature of the quicksilver industry in 1943 was the ability of North American producers to meet all wartime requirements, and in the latter part of the year to produce at a rate 50 percent in excess of wartime requirements. In the United States this was due largely to increased production from old and new properties operated by pre-war quicksilver producers.

Mexican production reached a peak during 1943, but there was some falling off in Mexican production in the latter months of the year.

Canadian production followed somewhat the same trend with some slight decrease in production during the last few months of the year.

Domestic mines, on the other hand, had rising production throughout the year with the highest monthly rate in the last few months.

At the present time the United States production is sufficient to supply all war demands without need for any imports. A further and most important factor is that reserves will probably permit the United States mines to supply full post-war requirements of the domestic market for some time to come regardless of prices, assuming there is some reduction in operating costs.

In spite of the fact that United States production can supply U. S. war requirements, Metals Reserve in late 1943 was still importing quicksilver from Mexico at prices higher than those obtained by west coast producers, and in addition absorbed the duty.

Canadian contracts were cancelled in the early fall, but Canadian production continues at a high rate, with the expectation that this quicksilver will be shipped into the open United States market early in 1944.

The State of California continued to be the largest quicksilver producer in the United States and the New Idria mine continued to be the largest single producer in that state. An outstanding feature of the year was the development of a considerable tonnage of high-grade ore at the New Idria property. In the latter part of the year the New Idria was producing at the highest monthly rate since before 1900. At the Mount Jackson mine, in Sonoma County, the grade of the ore improved as operations got below the older workings. At the New Almaden mine, south of San Jose, a large proportion of higher grade ore was coming from the underground workings. The New Almaden operation probably enjoys the reputation of having the lowest costs in the industry.

At the Reed mine of the Bradley Mining Company development during the year showed considerable promise as a continuing producer. There was no noteworthy development at the other California mines during the year.

In Oregon the Bonanza mine, near Sutherlin, continuing development at depth showed a smaller ore zone of somewhat higher grade. A single furnace was able to handle all tonnage from the property in place of three which operated there in previous years.

At Horse Heaven, in Jefferson County, Ore., mining caught up with development in August and the furnace is now on a stand-by basis, operating only when orders for quicksilver are received. A considerable tonnage of satisfactory ore is available for furnace operations. Almost all of the remaining Oregon mines reached the limits of their developed ore and shut down during the year.

In Idaho the new Hermes operation of Bonanza Quicksilver Mines, Inc., was an outstanding success. Production considerably in excess of 300 flasks a month was attained throughout the year with a large tonnage of developed ore in sight. Labor shortages and bad ground continue to hamper production at this property. This is the only producing property in Idaho since the shutdown of the Idaho Almaden property.

The outstanding producer in Nevada is the Cordero Mining Company at McDermitt and during the year large tonnages of high grade ore were discovered and have been in process of development. At the close of the year the furnace was put on a standby basis and operates when orders for quicksilver are received. Harold's Club operations continued with considerable success to find additional high grade. There were no other major developments in Nevada during the year.

In Texas production of quicksilver during the year was at a rather low rate. The Chisos-Rainbow changed ownership and an effort is being made to resume major production from these two old Texas properties. Other operations in the Big Bend country underwent little change.

In Arkansas the shutdown of the Humphreys furnace near the end of the year practically eliminated Arkansas from the quicksilver producing states. Current Arkansas production is probably not over a dozen or so flasks a month.

Furnace improvements which are becoming more widespread in the industry include hot rotary calcine conveyors and mercurial soot flotation as used by the Bradley Mining Company, stainless steel (18-8-S-MO) in the cold end of condenser systems, wet dust disposal methods as utilized in Lake County and the New Idria and ultra-violet stack gas and water analyses as used at Cordero Mining Company.

In metallurgical developments in the quicksilver industry a study of the furnace efficiencies of the principal American and Mexican producers seems to indicate that the average recovery lies between 90 percent and 96 percent.

The filing of numerous tax suits by the Department of Revenue in connection with the disallowance of quicksilver furnacing as a part of mining forced almost all of the principal operators to explore the advisability of junking their furnace installations and installing flotation. In almost all cases it appears possible to make the change if forced to by the Treasury and Department of Revenue interpretations of the law. Installation costs are approximately the same, efficiencies are approximately the same and operating costs are comparable. If pending tax cases before the Ninth Circuit Court result in adverse decisions to the quicksilver industry, a vast amount of good equipment would have to be junked by the operators so that an equal but no more efficient process may be installed. To the quicksilver operators this seems to be the high in needless unprintables but they are becoming somewhat immune to all types of Washington interpretations. Possibly a new word is needed in the industry "tax obsolescence"?

Ferroalloy Metals

Control of shipping lanes from foreign production sources and drop in projected alloy steel program end threatened shortages.

By FRANK HATCH
Assistant Director, Steel Division
War Production Board

THE THEME of our discussion of ferroalloy metals now is very much different than a little over a year ago. All of us are, in varying degrees, aware of the important changes that have taken place in the war program in that time—changes not so much as to the overall goal, as in emphasis, as the military requirements have shifted or have been modified. I don't think any of us will feel anything but gratitude and hopefulness that we should have reached our goal in any one phase of the war program or are faced with a plentiful or adequate supply of any of the needed war materials or equipment, with all that that implies. The ferroalloys, on the whole, are in just that position.

Two years ago, a year ago, and even less, we were still faced with shortages—shortages that threatened to limit our production of war material. What supply we did have was further threatened by interruption to production at the source (India, Africa, Australia and other places), and to the shipping lanes from those sources. Proper and adequate steps were taken to protect the war effort against these threats. Those dangers have now been largely removed. We are in complete control of North Africa and Australia and the shipping lanes are becoming relatively safe.

Furthermore, from a use point of view, military requirements have changed so that from a period of stretching for more production to meet a projected alloy steel program of 1,500,000 tons per month, we are actually seeing alloy steel production of less than 1,000,000 tons per month with a consequent reduction in the consumption of most ferroalloys.

With this reduction in the need for ferroalloys, certain of our extraordinary needs for manganese, chrome, tungsten, vanadium, and molybdenum among others no longer exist.

There are, of course, very vital and substantial requirements of these materials which the figures in Table I will indicate.

These figures show the enlarged needs of the War Program. To meet these requirements and insure an adequate supply at all times, both imports and domestic production had to be stimulated.

Back of these requirements, as a protection against contingencies to back up any interruption to production or imports, we now have stocks on hand in this country as shown in Table II.

It may also be of interest to cite a few figures to show the increases in domestic production which have been accomplished in these metals compared to the period before the war. (See Table III.)

Manganese

Manganese was really a major supply problem because of the combination of large tonnages and required movement by ocean shipping. The basic necessity for this material called for extraordinary steps to protect the war production program. Consequently, in addition to what high grade production could be obtained, low grade deposits and ore purchasing programs were developed. Fortunately, it has not been necessary to fall back on some of the supply that was developed as part of this emergency program. And as the situation has eased, it has been further possible to discontinue some of these programs no longer needed or justified for the successful prosecution of the war.

The stocks of material in this country of average metallurgical grade are now sufficient to take care of indicated requirements for more than a year.

TABLE I

	Consumption	
	Pre-War	Current - 1943
Manganese	674,583	1,400,000 tons
Chrome	362,873	900,000 tons
Tungsten	5,047,800	17,151,000 lbs.
Molybdenum	23,149,800	53,825,000 lbs.
Vanadium	1,519,600	3,672,000 lbs.

TABLE II

	Stocks, Dec. 31, 1943
Manganese	1,525,000 tons
Chrome	1,100,000 tons
Tungsten	18,683,000 lbs.
Molybdenum	29,674,000 lbs.
Vanadium (not including ore)	2,433,000 lbs.

TABLE III

	Ore Production	
	Pre-War	Current - 1943
Manganese	30,683	175,000 tons
Chrome	1,506	100,000 tons
Tungsten	2,803,600	10,274,000 lbs.
Molybdenum	23,130,200	58,726,000 lbs.
Vanadium	633,600	3,497,000 lbs.

(Tungsten, molybdenum and vanadium figures are in pounds of recoverable metal or equivalent after deducting refining losses.)

Address presented to combined meeting of the Western Division, American Mining Congress and the Colorado Mining Association, Denver, Colo., January, 1944.

Chrome

To a large extent, chrome has been in a similar position to manganese. Low grade ore production and ore purchasing programs were designed as part of an "emergency insurance" program. Subsequently, it has been possible to discontinue a large part of this "security" production and ore buying.

The production of chrome ores in this country during this year (1944) will fall well below that for 1943 due to the grade and undesirability from a use viewpoint, although importation of high grade lumpy metallurgical ore for ferro-chrome will continue as far as possible to meet requirements.

Tungsten

The requirements of tungsten have been expanded some three-fold as a result of the military program from the pre-war level. This need has been met by an almost parallel increase in both domestic production and in the new supply obtained from foreign countries.

Widespread government aid in many forms has aided in this accomplishment. Tungsten, however, has been one of the ferroalloys most directly affected by the changes in the military program and the decline in alloy steel production cited earlier.

It is ironical that tungsten should be well in the front ranks as far as increased new supply is concerned and at the same time, one of these affected by the drop in alloy steel production, in spite of increased requirements for other than metallurgical uses. The present procurement program projected through 1944 would create a serious unbalanced position in the supply of tungsten.

Molybdenum

Molybdenum (moly) has been largely a domestic supply problem although the contributions of that metal by our good neighbors immediately to the South and to the Far South have by no means been negligible.

The United States has been exceedingly fortunate to have the state of Colorado for, among other things, its remarkable sources of molybdenum. As you all well know, this State has contributed a lion's share of the world's supply of molybdenum which has been such an essential material in the United Nation's war production program. The search for additional molybdenum earlier in the war has produced few deposits where production has been feasible with proper respect for other requirements and needs. One important new source of molybdenum, however, appears to be well on the way to production—an operation which is completely in the hands of private industry.

With tungsten, moly has been directly affected by the course of alloy steel production and existing independent sources are more than adequate to meet present requirements without any need for government aid. Furthermore, stocks of molybdenum are now at a point which has been officially determined as a safe minimum.

Vanadium

Few would have predicted several years ago that vanadium production from domestic sources would increase as quickly and to the degree that has been experienced. In this respect, in the efforts to produce vanadium for war uses not only have the requirements been met and adequate reserves developed to protect those requirements, but new potential reserves have been added to our national resources for possible future emergency use.

From the immediate war use pattern, vanadium falls in alongside tungsten and molybdenum. Vanadium has rapidly traversed the course from a screaming deficiency which necessitated widespread government activity to the point where complete withdrawal by the government is under way.

Nickel

Nickel, although not in abundance to the degree of the other ferroalloy metals, nevertheless has reached a point where all essential requirements are being met through increased Canadian production and small importations. Large low grade deposits earlier considered for their possible value as a potential source of this metal cannot be justifiably brought into the production arena at the present time in the overall interest of the war effort.

Cobalt

Cobalt has long since been one of the metals whose supply has been more than adequate to meet the war requirements, although some domestic production instituted during the early days of threats to ocean shipping have been continued as a part of an insurance program against complete dependency on faraway sources of this metal. Supplies of cobalt on hand in the United States are more than sufficient to meet full requirements for more than a year.

Bin and loading chute at Grau Chrome Mine, Calif.

Rutile, Zircon, Baddeleyite and Columbium

Rutile, zircon, baddeleyite, and columbium are in varying degrees in a somewhat similar position either as to adequacy of new supply or stocks on hand so that no further extraordinary measures of procurement involving government aid are contemplated at this time.

The ferroalloys, in summary, have happily reached a point of balance with adequate stocks and current new supply, at least adequate to meet all present and indicated requirements.

It remains, however, to maintain that balance and especially to maintain the adequacy of current new supply. There is a quota to be met. That cannot be too strongly emphasized. The difference in degree of production in no sense lessens the importance of that production or the dependence of the war production program and of the armed forces on that quota. In this connection, it is also important that users of ferroalloy materials appreciate that the current balanced position of these metals in no sense means, or should imply, that all restrictions with respect to these metals can be disregarded. In other words, it will not be possible for industry to revert, as yet, completely to the metallurgical pattern of the pre-war period.

One can hardly speak of adequate stocks and indicated surpluses without at least a cursory recognition of the widely discussed question of stockpiling and the policy with which the government will deal with surpluses.

Until that function is allocated and defined and the policy with respect to future treatment or accumulation of stockpiles is determined, presumably by legislation, certain confusions and difficulties are bound to arise in the minds of both the producers and consumers with the government agency, unfortunately, in the middle. I feel confident, however, that the Western miners, on the whole, will respond to this phase of the program in the same fine spirit and with the same fine purpose and accomplishment as has thus far characterized their unprecedented and splendid contribution to the war effort.

Mercury, Silver and Miscellaneous Minerals

By RICHARD J. LUND
Director, Miscellaneous Minerals Division
War Production Board

ALTHOUGH the activities of the Miscellaneous Minerals Division, War Production Board, are concerned with some 50 miscellaneous metals and nonmetallic minerals and commodities, particular attention is directed here to two of the metals—mercury and silver—which are of particular interest to the Western mining industry, and cover only the barest highlights of other metals such as platinum and a number of the minor nonmetals.

Mercury

I think I can say that in 1943 mercury led the field among the prominent metals in the transition from a somewhat tight to a very easy supply position. This resulted mainly from a great reduction in requirements, which during the year were virtually cut in half. The situation was further eased by accelerated domestic production and imports, which exceeded estimates made early in the year. Requirements fell from a figure of approximately 90,000 flasks as estimated early in the year to actual consumption of about 54,000 flasks—a major part of which reduction resulted from the cancellation of a very large export demand.

It was estimated by industry early in the year that domestic production would drop some 10 percent below the 50,000 flask output in 1942; however, instead of a decrease, domestic mine output actually increased to a total of almost 54,000 flasks for the entire year. Imports, which are largely from Mexico and Canada, held up very closely to the 50,000 flasks estimated early in the year.

In effect, domestic production has virtually satisfied domestic consumption during the year, and imports have greatly augmented the Government stockpile, which at the end of the year approximated two years' domestic requirements at the current consumption rate.

It was decided late in the summer that growing stocks and excess new supplies created a situation that would not warrant further Government help through financing, granting priority assistance to any new mercury mining project, or material help on manpower problems to the industry. The entire situation was reviewed in detail with producers at the Industry Advisory Committee meeting held early in October, at which the need was pointed out for reducing or curtailing domestic production and imports by 30 percent, in order to maintain new supplies at approximate consumption levels. Industry at that time anticipated that within 60 to 90 days' output would be reduced by approximately 30 percent as a result of serious manpower problems, but that anticipation failed to materialize and actual production in the fourth quarter was greater than any other quarter in 1943.

With surpluses increasing at an accelerated rate in December, the War Production Board recommended to Metals Reserve Company the cancellation of contracts with qualified mercury producers in accordance with provisions incorporated in the original contracts. This Government purchase program was in effect a subsidy to encourage all domestic producers to operate at maximum capacity during the existence of the contract. Cancellation notices to become effective January 31, 1944, were mailed by Metals Reserve Company to the contract holders on the last day of 1943. Under the cancellation clause such producers are to receive $20 per flask for what is roughly their capacity to produce during the last 11 months of 1944. Actual settlement will be based on the average monthly output during the six months preceding January 31, 1944.

In line, also, with the easier supply position, Conservation Order M-78 was relaxed considerably in September, and consideration is presently being given to further relaxation of the few restrictions remaining which pertain to the use of mercury by industry.

Problems relating to foreign metal are of course handled by the Foreign Economic Administration, and purchases are continuing as a result of recommendations as to quantity made in 1943 by the War Production Board covering 1943 and 1944. Such purchases are being continued during January, 1944, at $174 per flask, Laredo, and thereafter it is our understanding that purchases will be made at approximately the American mar-

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ket less $19 per flask and less freight from Laredo to New York.

In recent weeks surplus supplies have resulted in the lowering of quoted New York prices for mercury from $190 per flask to $130 per flask.

In summary, the mercury mining industry is already fairly well immersed in problems involved in the transition from all-out record war production to more normal rates. To the great credit of the industry it can be stated that at no time during the war period has there been any failure to satisfy war and essential civilian requirements, and the present position in the industry is excellent insurance that this situation will continue during the remainder of the war.

Silver

The major problems arising in silver distribution in 1943 came as a result of greatly reduced supplies of foreign silver coming from Mexico. As a result, it became urgently necessary in the summer to have legislation passed to authorize the sale of Treasury silver for domestic industrial use. The Green Bill, as you well know, was finally enacted as Public 137 on July 12, 1943. It authorized the sale of Treasury silver for domestic purposes by the Secretary of the Treasury upon the recommendation of the Chairman of the War Production Board. Since then adequate silver supplies have been available for all war and essential civilian uses and also for less essential civilian uses at a restricted rate—50 percent of their use in either 1941 or 1942.

Total net industrial consumption in 1943 is now estimated at about 125,000,000 ounces, of which about 80,000,000 ounces represent war and essential civilian uses. Consumption in the manufacture of silverware, jewelry, watch cases, pens, pencils, etc., accounts for most of the balance. Estimates of requirements made early in the year were much higher than the consumption figures stated above. Most uses figured in the cutback, but a major factor was the clarification of actual net consumption in the bearing industry—one of the largest consuming fields—in which the scrap return is very large, coupled with actual reduced requirements for silver for bearings resulting from thinner plating specifications and a lowering of spares in the production program.

Domestic production decreased from about 54,000,000 ounces in 1942 to an estimated 42,000,000 ounces in 1943. Even with this reduction newly mined domestic supplies were adequate to meet the restricted demand by nonessential users who are required to use this kind of silver.

As already stated, foreign supplies were greatly reduced during the year from an estimated 100,000,000 ounces based on import rates early in the year to approximately 60,000,000 ounces. The major part of this reduction was felt during the last six months of the year when only approximately 20,000,000 ounces, mostly in the form of ore and base bullion, were imported, occasioned in major part from the urgent need in Mexico, whose mint was operated at capacity to provide their expanded economy with needed silver coinage.

Problems arising from the necessity of distributing foreign silver at 45 cents per ounce and Treasury silver at 71 cents per ounce to essential users required major consideration during most of the year. I will not go into detail, but it was finally decided to require certain major segments of the consuming industry to use Treasury silver rather than to require all essential users to take stipulated percentages of each of these kinds of silver. Complications resulting from attempts made to minimize the risks of such industries against possible losses on inventory at the end of the war have been a strain on these industries and the Government. This holds true particularly for the manufacturers of silver engine bearings, but it now appears that these difficulties will soon be solved.

During the year the program to utilize Treasury "free" silver on loan in the manufacture of bus bars and other large nondissipative uses was completed, in which program approximately 30,000 tons of copper have been saved. A proposal to extend such uses to include overhead transmission lines was disapproved.

Other major demands for Treasury "free" silver arose from various foreign governments requiring such silver for coinage and industrial purposes, effectuated through lend-leasing the silver which will be returned in kind as soon as possible after the war. These demands, in our opinion, will continue in increasing quantities for some time.

It is estimated that in 1944, if imports continue at the present curtailed rate, there will be a need for some 50-75 million ounces of Treasury "free" silver for use in essential civilian and war industries, without taking into account several potential major new uses on the horizon. Faced with the demand for Treasury "free" silver for (1) established war uses now consuming this kind of silver, (2) major potential new war uses on the horizon, (3) heavy domestic coinage, and (4) probable large foreign lend-lease requirements, it appears at this time inadvisable to consider relaxation of present restrictions in the use of silver for less essential purposes, since any increase in such uses would have to be met largely from Treasury "free" silver.

REVIEW and OUTLOOK for MINING

Platinum Metals

Essential requirements for all of the platinum metals—including, in addition to platinum, iridium, ruthenium, rhodium, osmium and palladium—were met completely in 1943, although by so doing it was necessary in some instances to draw on reserve stocks, either domestic or foreign.

For platinum itself, record-breaking consumption levels were reached largely because of heavy demands in new electronics and electrical uses. If all essential demands, both real and potential, are to be met in 1944 without drawing stocks down to a dangerously low level, a substantial return from the salvage programs for used radio tubes and contact points now being pressed by the military services must be realized. A program to make available for industrial use idle stocks held mainly for investment or speculation involving very substantial amounts of metal is actively under way. Most of our new supplies are imported from Canada and Colombia for refining in this country, augmented by sizable imports of refined metal from Russia. Domestic primary production comes mainly from the Goodnews Bay dredging operation in Alaska.

Shortages of iridium, which serves as a hardener for platinum, for electrical uses made it advisable to place this metal under allocation in midyear, since when the supply situation, largely as a result of major substitution of ruthenium as a hardening agent, turned much easier later in the year. This substitution, which was pushed initially because a partial substitution for iridium was necessary, has progressed farther than needed, to the point where the major original iridium uses are now being met in substational part by ruthenium, and the remaining iridium use is being met largely through stock withdrawals rather than from new production.

Heavy military demands for rhodium for searchlights and catalysis (alloyed with platinum for use in ammonia oxidation) have been met by prohibiting its use in jewelry and switching from 10 percent to 5 percent rhodium-platinum alloy for catalysis. These measures combined with reduced military requirements resulted in stock increases in 1943. Under these conditions a move was made to revert to the 10 percent alloy because of its greater efficiency and the resultant saving in platinum consumption.

Wartime consumption of ruthenium has increased from five to ten times that of pre-war levels, largely as a result of substitution for iridium in jewelry use and of its partial substitution for iridium in war and essential

electrical uses. This increase has been met in considerable part from heavy stocks built up prior to the war.

Diamonds

Although diamonds, from a supply standpoint, are not a problem of the domestic mining industry, mining companies are much concerned with diamond supplies from the standpoint of the consumer, since the use of diamonds in rock drilling constitutes an important segment in their total industrial use.

Industrial requirements for diamonds increased from five to ten times those of pre-war levels. An outstanding feature for this material has been that this increased consumption has been met during a period of actual decline in new mine production, with all pipe mines in South Africa having been closed until recently and large production from the Congo showing a marked drop. Requirements have been met only because the Diamond Corporation and the diamond-producing companies in Africa had previously built up very large stocks which have since been substantially reduced.

Of interest to the importing and consuming trade is the fact that effective for the remainder of the war period we have recently been able to work out with the British a change in marketing methods whereby descriptive analyses of certain series of goods, by sizes and categories, would be made available to the trade in advance so that they would have more information as to the quality of the goods purchased at the time advance payment has to be made.

A comprehensive investigation by the War Metallurgy Committee on conservation and substitution of diamonds indicates the definite possibility of using cheaper bortish material for costlier and scarcer transparent diamonds for dressing grinding wheels—a major use for so-called industrial stones.

Shortages of drilling material in particular sizes may have to be met by substitution of either smaller or larger sized diamonds in the manufacture of bits.

Quartz Crystals

Wartime consumption of quartz crystals has increased almost fifty-fold compared with pre-war levels, necessitating a large increase in output in Brazil, virtually the only world supplier. The total value of this imported raw material has risen to the point where it can no longer be considered a minor nonmetal. For instance, at present rates the value of quartz exports from Brazil is at approximately the same level as that for phosphate rock produced in the United States in 1941, and exceeds the combined value of 1941 domestic production of crude feldspar, fluorspar and crude gypsum.

This increase in Brazilian output was accomplished in part by price stimulation which has not been controlled by any specific OPA order and in part by United States Government assistance in mechanizing many of the Brazilian producing properties.

During 1943 a serious attempt was made to discover and exploit domestic deposits, but the material recovered has proved too low grade for continued operations.

Heavy consumption of radio-grade quartz crystals, including stockpiling under the established program, could not have been met solely through increased production. A major contribution here was the energetic conservation and substitution program pushed by the Government late in 1942 and early in 1943 which resulted in discovering the usability of inferior quartz for manufacture of satisfactory radio oscillators. Scrap recovery also contributed substantially to this program. Another outstanding part of the conservation program was the drive to increase cutting efficiency and at the same time where possible to redesign oscillators to smaller sizes, thereby securing many more oscillators per pound of usable material. In this connection, progress made during the period 1942-1943 raised production efficiency from seven plates per pound to seventeen plates per pound of raw material cut.

Corundum

Requirements have more than tripled compared with the pre-war period, but strict allocation has held consumption down to the available supplies, including substantial domestic stock withdrawals. We have been unable to obtain the full increase in African output necessary to meet the total demand, and have therefore reopened old corundum workings in Canada and the United States. At best, however, material from these sources will approximate only about 10 percent of our requirements. An outstanding event in the corundum picture has been the move to substitute garnet—both in larger grain sizes and in the superfines—for corundum; indications point to some success in this substitution, although optical companies have reported recently that this substitution would be made by them only as a last resort because of the additional materials, facilities, and manpower needed under the change.

Feldspar

Production of ground feldspar in the United States has been maintained at approximately the pre-war rate of about 350,000 short tons per year. During 1943 production of ground spar was maintained only by processing large stocks of crude feldspar normally held in reserve plus the crude material being currently mined. These reserve stocks are now nearly depleted so that production of ground spar may be expected to decline in the future because of the reduced quantity of crude spar now being mined.

The decrease in output of crude spar is due both to loss of labor directly to the armed forces and to the diversion of a substantial percentage of the feldspar miners to the production of strategic mica. This diversion program was carried out because of the higher essentiality of strategic mica, and although strenuous efforts have been made to maintain feldspar production it has not been possible to hold it at former levels. Because in the past the supply of ground feldspar has been adequate to supply requirements, principally in the ceramic industry, this mineral has never been considered critical nor has its essentiality to the war program been fully recognized.

One of the largest uses for feldspar is for the manufacture of glass containers, which consumes approximately 60 percent of the total production. Other important and essential uses are the manufacture of vitreous dinnerware and sanitary ware, vitrified grinding wheels, welding rod coatings, and in Army and Navy soaps and abrasive powders. A very good case of essentiality could doubtless be established for at least 80 percent of the total feldspar consumption. In the Materials Substitution and Supply List released by the Conservation Division, feldspar has recently been moved from List III to List II indicating a tightening supply.

Spodumene

Requirements for spodumene and other lithium-bearing minerals have increased from five to six times pre-war levels. It was possible to meet these heavy demands only by utilizing new concentrating techniques involving froth flotation at two new plants, one in North Carolina and one in the Black Hills, thus making available the large quantities of an acceptable product needed by the consuming industries from the known large quantities of lower-grade reserves in the ground.

Talc

The general supply picture on talc is satisfactory. The production of steatite talc has been increased to a point where not only are all essential requirements adequately supplied, but an excess supply exists for use in non-essential products such as cosmetics.

The supply of nonsteatite or fibrous talc in the West Coast area has also greatly increased to the point where producers are searching for new markets.

Only in the fibrous talc producing region of New York is there any lack of ample supply. Producing companies in this area are currently about three weeks behind in shipments but this condition is expected to be only temporary. The supply of nonsteatite talc

(*Continued on page* 102)

Progress in Metal Mining Practice

Forward steps registered in mining methods and application of equipment. Manpower and equipment shortages bring on training schools and intensive maintenance programs.

By J. MURRAY RIDDELL
Manager, Mining Division
E. J. Longyear Company

THE METAL mining industry during 1943 was confronted by many unusual and complex problems—too numerous to completely mention and all directly related to the war effort. Nevertheless, these entwined conditions did not prevent the industry from making advance in method and application.

Throughout the year the demand for labor was greater than the supply. In a number of districts mining trade schools were initiated, with the objective of converting unskilled labor to the trades of miner, shift boss, and laboratory technician. Those who are intimately familiar with the results achieved report a commendable and well worth-while accomplishment—especially so as related to the supervisory phases of training.

Shortage of manpower necessitated the employment of women as analysts in the laboratories. In the Lake Superior iron ore districts the teaching staffs of the high schools and junior colleges cooperated with industry to train women for such work. In most instances, the women who availed themselves of the opportunity had had previous college training. For tasks of such a routine nature, women have proved themselves capable and dependable.

In the spirit of "get along with what you have and meet the schedule," operators were obliged to maintain equipment and develop initiative as never before—not so much that funds were lacking, but because replacements were difficult, if not nearly impossible, to procure. Patch and build-up welding played an ever important role. The bit diameters of drill steel were subjected to intensified study—as was the change in gauge diameters. On the whole, starter diameters were lessened. Where changes were feasible, increased drilling speed was accomplished and unit costs lowered.

Drilling Developments

Mechanically fed drill machines rapidly replaced the hand-fed types. There was the tendency toward longer feeds for drill machines, especially so where ground conditions were of such a nature that the drill steel bit was not completely dulled with the previously accepted standards; one company experimented with a 4-ft. feed.

While there appeared to be no great change in drilling patterns, nevertheless, it was noted that there was an increased interest in the "burned cut." Jumbo drill mountings advanced in popularity as compared with the fixed column.

The general use of the diamond drill for blast hole drilling in mines in North America increased, in spite of limited curtailment of drilling at certain Canadian mines where drilling programs were advanced several months ahead of blasting operations. Of the total diamond drilling in Canada in 1943, probably over one-third was for blast holes. Canada still held the lead in the use of long hole diamond drilling for stoping operations, but several additional mines in the United States undertook such operations or started practical experimental work. Although considerable experimental and research work was being carried out, neither manufacturing nor mining companies announced any major improvements in equipment or methods. Constant research improved the quality of the bit setting; the trend was away from the casting of the matrix that holds the stones and toward a powder metallurgy process. Uses of the diamond drill for blast holes included: (1) breast drilling, (2) ring drilling from sub-level drifts, (3) horizontal ring drilling from raises, (4) vertical drilling from sub-level benches, and (5) a variety of drilling methods for pillar recovery.

Training women as analysts in the laboratories of the Oliver Iron Mining Company

In the loading out of broken ore or rock from main level headings mechanically, there was evidence of a swing toward the shovel type of apparatus as against the scraper and tugger hoist method; however, the latter method continued to hold its prominent place in the moving of materials in sub-levels and stopes.

The adaptation of the method of mechanized vertical shaft mucking by means of "clam shelling," as first introduced at Barberton, Ohio, during 1942, has been expanded.

In the open pit operations several noteworthy advancements were made. Where the pits became deeper and railroad grades difficult, more and better inclined belt conveyors were placed in service. At one of the Mesabi Range properties there was placed in oper-

ation a steel cable cord rubber belt—the pertinent data of which is: inclined length, center line pulleys—1,047 ft.; grade—13°25′; single lift—252 ft.; speed—500 f.p.m.; drive—one 250-hp. A.C. slip ring motor; belt—32-in. width, steel cable cords on neutral axis with two-ply fabric direct on bottom; capacity—715 long tons per hour. The operation of the just described installation has proved to be highly successful.

Motor Truck Haulage Increases in Open Pits

With steeper grades to be negotiated in the pits, the use of motor truck haulage increased. Conditions permitting, there was a marked trend toward the use of the larger units, namely, semi-trailer type side dump—75,000 lb. net live load. The use of butane for motor fuel in new and revamped motors was introduced; those who adopted it bespeak its merit as to related over-all economy.

Power shovels did not undergo any major change, due to the heavy volume of Government orders placed with the manufacturers. In metal mining the standard size of shovel seemed to continue between the limits of 3- and 5-cu. yd. capacities. With the heavy-duty type of equipment, there was a tendency toward increasing the dipper capacity, other things being equal. It is believed that the principal development on shovels during 1943 was the introduction and use of individual exciters for the various generators on the motor generator set—General Electric Company's Anplydine control or Westinghouse Company's Rototrol.

Where dragline operations of magnitude were involved, and where it was possible to obtain new equipment, the "walking" type of supporting and propelling mechanism increased comparatively — because of its greater versatility.

Railroad equipment in the pits did not undergo any major change. The use of roller bearings increased. Diesel electric locomotives increased in popularity, and there was the trend toward the use of larger units.

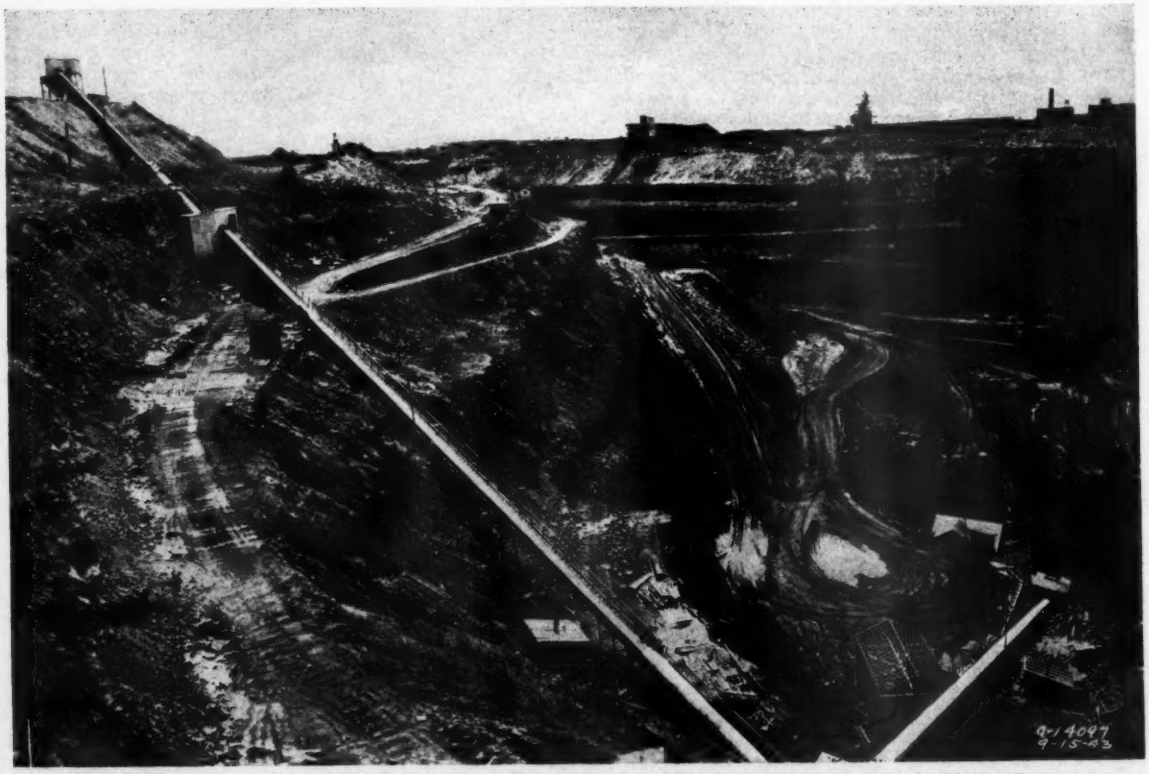
Small power shovels working with related capacity trucks and dumptors proved efficient in scramming with a number of operators.

While there was no marked change in the quality of explosives used for blasting, manufacturers did improve cartridge preparation and stemming containers. In quarry work, the use of primacord appeared to be increasing in popularity. The U. S. Bureau of Mines issued a series of progress reports on stemming in metal mining which bore commendation.

As to the Lake Superior Iron Ore Ranges: A shorter shipping season in 1943—compared with the previous year—presented a problem; monthly production and shipping records reached an all-time high—the latter figure approximated 14,000,000 long tons. Noteworthy was the work done in stream diversion for the ultimate winning of ore, namely, at Embarrass, Minn., and Steep Rock, Ont. At the open pit of the Plymouth Mine, Wakefield, Mich., there was abandoned the use of standard railway equipment for removing ore in favor of the use of an inclined skipway, placed on the bank of the pit.

As of the close of the year, the 5-ft. 6-in. diameter vertical borehole which was being sunk at the Cary Mine, Hurley, Wis., in granite, the depth approximated 2,000 ft.; this work was started in August, 1942. The depth attained makes it the world's deepest borehole put down by a shot drill method; the planned eventual depth is 2,585 ft.; ultimately, it will be stripped for a shaft.

In the Butte, Mont., district, a new mining method—which is a variation of square-set stoping, locally termed "slot" stoping—was devised for the mining of wide ore bodies in heavy ground. The stopes extended from foot wall to hanging wall, and went three sets along the strike. The most advanced line of sets was held open for the full width of the stopes, and the entire "slot" served as a chute until the 3-set block was completed. When the next adjacent block was mined, the



Conveyor line—32-in. belt in three sections of 320 ft. each, 18° inclination—Webb mine, Snyder Mining Co.

"slot" was used for service raise and waste chute; and a new "slot" line was lagged off for the mining chute. In the "slot" method, breaking and filling were independent operations, which made possible a nearly continuous breaking cycle. The arrangement of slides was simpler than in the usual square-set stope; dead work was minimized and hand mucking practically eliminated. The result was fast, low-cost mining.

At Butte, during the year a new steel headframe was erected over the old Leonard headframe, and a new modern Westinghouse-Nordberg ore hoist installed. The General Electric-Nordberg ore hoist formerly used at the Elm Orlu Mine was installed for balance hoisting of cages in two compartments of the same shaft for handling men and supplies. Successful operation of the bottom dump skips at the Emma Mine resulted in a decision to equip the Leonard Shaft with large capacity skips of this type.

In the western mines using air-conditioning, the plants were greatly extended with a trend to the use of a large number of small units instead of a few large units. Conducting the reconditioned air from the outlets of the cooling units to the working areas by means of large diameter Ventube has resulted in increased efficiency over the former practice of passing the cool air through regular drifts and cross-cuts. A number of new surface ventilating fans were installed; these units, which are reversible and consist of backward-tipped blade rotors, directly connected to 500-hp. motors, are capable of handling 250,000 cu. ft. of air at 9 in. of water.

Shovel loading ore cars drawn by diesel locomotive at Hull-Rust open pit mine of the Oliver Iron Mining Company

At Cananea, Mexico, plans were completed to develop a large open pit low-grade ore project. The planned open pit operations will be served by 4½-cu. yd. electrical shovels and 23-cu. yd. trucks.

Bituminous Coal Research

(*Continued from page* 44)

supporting the work by less than the standard rate of subscription.

There are many problems confronting the coal industry in which research can be very helpful and there is now a going research organization which can handle them well, and which should be used by the industry to a much greater capacity than it has been. During the past years the advisory committees and officers of B. C. R. have considered many problems suggested and the directors have recently approved a five-year program involving the expenditure of $500,000 per year which has been presented to the industry for the funds necessary to make it effective. The response has been more than gratifying and in spite of the adverse conditions under which the companies are operating it is confidently expected that the total of 150,000,000 tons necessary to initiate the new program will be reached by the time this paper appears in print.

In this new program many problems are grouped under the heads of residential heating; industrial and commercial steam uses; non-industrial and special uses; coal, combustion and ash; carbonization; gasification; preparation, transportation and handling; railroad fuel and locomotive development; chemicals from coal mining; and in addition, the technical service involved in handling these problems. The groups are not named in the order of their importance, and they will all not be started at the same time; changes will be made from time to time, some problems may be dropped and many will be added. The organization to handle this work must of course be much larger than it has been in the past.

Iron Review

(*Continued from page* 70)

the pattern for 1944 and make downward revisions if they are indicated. Meanwhile plenty of difficulties loom immediately ahead for the iron ore producers, mainly acute problems of manpower supply.

As the war proceeds to an expected climax in 1944, more thought naturally is being given to the aftermath and to the possible requirements for raw materials to make all the things expected to be needed by a world returning to sanity. Such widespread destruction by war, unless it is to end in hopeless exhaustion and human stupor, must be followed by wholesale reconstruction. If the normal wants and needs of people are to be satisfied in some measure, and if the inner forces that motivate people survive, without too many inhibitions, burdens and restrictions, the basis for an era of great production surely exists. Iron and steel are certain to play a large role in such an era, hence the iron ore mining industry may expect to find that it retains quite as important a niche in the post-war world as it fills at present in the war, or ever filled in the past.

NOTE: The writer acknowledges with gratitude the assistance of many friends connected with the iron ore industry in reporting items referred to herein; also the use of material in various official releases, trade magazines and other publications from which notes have been taken. It is hoped that their assembly herein has been of some interest and value to the readers.

Nonferrous Secondary Metals*

Nonferrous metals supply sustained by all-out salvage drive.

By F. H. WRIGHT
Secondary Metals Section
Bureau of Mines

NONFERROUS secondary metals promoted the all-out production drive in 1943 with record-breaking quantities of brass and aluminum salvaged from industrial scrap. The flow of segregated clippings and turnings to remelters was maintained in a never-ending stream with such dispatch that corrosion and contamination were held to a minimum, and an unusual proportion of the new scrap available was suitable for blending with primary metal in alloy production to standard specifications. Even toward the end of the year, when the supply of nonferrous metals caught up with requirements, only a few types of scrap such as leaded-brass rod turnings and mixed aluminum started to pile up enough to cause concern.

Sources of old scrap were depleted, and collection drives in various parts of the country had little success, but the quantity of obsolete and worn-out metal parts unearthed by scrap-metal dealers was nevertheless larger than had been expected, particularly in the face of a severe labor shortage brought about by the drain to both the armed services and higher-paid industries.

Copper and Brass

Recovery of secondary copper, for the most part in brass and bronze, is believed to have exceeded 1,000,000 short tons in 1943 and involved the processing of almost 1,500,000 tons of purchased scrap and residues. Old scrap contributed about 40 percent and new scrap the other 60 percent of the total secondary copper. Preliminary estimates indicate that recovery was divided by industry groups approximately as follows: Brass mills, 41 percent; ingot makers, 37 percent; refiners, 12 percent; and all others, 10 percent.

Production of ingot brass and bronze for casting was increased about 20 percent above the 1942 high to more than 480,000 tons in 1943, but a number of unusual expedients were needed to attain this record. Although both production methods and pricing in the brass-ingot industry had been based upon the use of scrap with only minor additions of alloying elements, unusually large quantities of refined copper and tin were required last year. Supplies of red brass, bronze, and unalloyed copper scrap were so far below the quantities needed that new gilding metal scrap from cartridge makers and pre-war reserves of semi-fabricated brass and copper shapes from manufacturers' stocks were allocated to ingot makers; as a further device, low-grade materials such as skimmings and irony red brass of the type usually consumed at refineries were run down in cupolas at a number of ingot plants to provide a tin-bearing process ingot usable in red composition.

Manganese bronze was again the most important of the high-zinc brass ingot alloys, continuing the tremendously expanded production of 1942, and substantial quantities of fired cartridge cases were disposed of in this alloy.

Scrap-metal dealers were beset with difficulties during 1943, between struggling to meet the demand for unalloyed copper and red brass scrap and trying to find markets for the yellow grades. There was insufficient outlet for some types of rod turnings, and rod-brass scrap stocks rose considerably during the latter half of the year. Surprisingly, dealers' shipments of copper and brass scrap to consumers in 1943 exceeded the quantity supplied in 1942 by a slight margin.

Ceiling prices were in effect for brass ingot and for most grades of copper and brass scrap throughout 1943. The maximum selling price stayed at 9.75 cents a pound for No. 1 copper and 9.00 cents for No. 1 red composition, while dealers' buying priees for these items at New York were quoted throughout the year at 9.37 and 8.87 cents, respectively.

Ingot makers' demand for leaded yellow brass was poor, and dealers were encouraged to sell unsorted yellow brass as "refinery brass," with ceilings for this type of scrap set at 8.00 cents a pound of copper content for material exceeding 60 percent copper and 7.75 cents for material between 50 and 60 percent copper. In the latter half of the year, some of the yellow grades of brass mill scrap brought one-quarter to one cent less than ceilings in sales to consumers, and dealers' buying prices were correspondingly low.

Government orders affecting the allocation of copper-base scrap were amended on March 1 to cover fired cartridge cases and bullet jackets, and strict control was exercised over all copper and brass-scrap consumption throughout the year.

Aluminum

In 1943 secondary aluminum† not only totaled almost five times the quantity recovered from scrap in 1939 but also far exceeded the entire domestic production of both primary and secondary aluminum in that year. Recovery in the past 12 months reached an estimated 242,000 tons compared with 198,492 tons reclaimed in 1942. According to a preliminary estimate, secondary smelters produced 185,000 tons of aluminum ingot, which included approximately 164,000 tons of metal recovered from scrap, and rolling mills followed with close to 78,000 tons of aluminum reclaimed from segregated wrought scrap.

As in the preceding year, the flow of scrap was channeled to remelters of proved efficiency, and more than 90 percent of the gross weight of scrap was recovered as metal. At least 266,000 tons of scrap were processed, but less than 40,000 tons of this represented old metal returning from use, and the downward trend in salvage of old scrap continued for the fourth consecutive year.

A rising tide of new aluminum scrap surpassed the limits of absorption toward the middle of 1943, and starting in June a surplus backed up in the hands of dealers at a rate exceeding 2,000 tons per month. Stocks in dealers' yards rose from 8,720 tons on January 1 to almost 24,000 tons at the end of 1943, despite shipments of approximately 130,000 tons to consumers during the year. Crashed aircraft constituted part of the station-

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† Aluminum and aluminum alloys, including alloy constituents, recovered from aluminum scrap.

ary inventory, some dealers having purchased lots of more than 250 tons in a single month, and much of this material will probably stand untouched until labor is available for breaking it up.

Ceiling prices for aluminum scrap in large lots opened the year at 11.5 cents a pound for segregated new clips and 10 cents for old castings but were reduced in June and again in December to close the year at 10 and 7.5 cents, respectively. Much aluminum scrap is said to have moved below even the reduced ceilings in the latter half of 1943. Maximum prices for secondary ingot followed the same pattern, dropping from the 15-cent basic price in January to 13 cents in June, then to 12.5 cents in December, but actual selling prices were still lower toward the end of the year.

Zinc

Recovery of secondary zinc rose to approximately 353,080 short tons in 1943 compared with 330,526 tons in 1942, but for the second consecutive year the rise was attributed entirely to increased reclamation of zinc in brass made from the record volume of copper-alloy scrap. Recovery of secondary zinc from zinc-base scrap totaled only about 117,080 tons in 1943, showing a 6 percent drop from the year before.

Less metallic zinc scrap was available because the backlog of old scrap, such as printing plates and die-cast automobile parts, had been substantially reduced the year before, and consumption of galvanizers' dross and skimmings was also less than in 1942; but use of flue dust and chemical residues was increased to such an extent that the total zinc-base scrap consumed was approximately 182,150 short tons (gross weight) compared with 180,830 tons the year before. An increased tendency to work brass-plant flue dust in with zinc ore as a raw material was noted among primary zinc smelters, and greater quantities were used at chemical works. Old zinc die-cast scrap was consumed to some extent in manganese bronze and in bright galvanizing, both applications taking advantage of the aluminum content of the die-cast metal.

Recovery of secondary zinc in redistilled slab decreased, but recovery in zinc dust increased by a like amount so that the sum of the two was only slightly less than in 1942.

Early in 1943 a general zinc shortage forced the Government to amend refined-zinc regulations to include remelt zinc in the list of completely allocated materials, and the disposal of zinc scrap was put under control.

Maximum selling prices for zinc scrap were unchanged throughout 1943, with new zinc clippings at 7.25 cents a pound and old zinc scrap at 5.75 cents. Dealers' buying prices for new zinc clippings at New York were quoted at 6.00 cents a pound at the beginning of the year but dropped to 5.85 cents in March and to 5.63 cents in December. Quotations for old zinc scrap held at 4.13 cents a pound all year, although there were indications of purchases at lower prices in all but the first few months. Dealers' stocks of zinc-base scrap showed a declining trend during 1943, except for a set-back in July when shipments to consumers dropped temporarily.

Lead

Recovery of secondary lead in all forms rose 6 percent to approximately 342,000 short tons in 1943 compared with 323,001 tons in 1942. Demand for secondary lead was not particularly strong at any time during the year, for domestic primary production plus imports were maintained at such a level that the total supply, including secondary metal, was always sufficient to cover permitted uses.

Consumption of lead-base scrap totaled approximately 426,000 short tons (gross weight) in 1943 compared with 396,531 tons in 1942, and the increase was spread among almost all classes of scrap. About 231,000 tons of battery plates were smelted last year, showing a slight gain over the 221,582 tons used in 1942 but still far below the 264,190 tons recorded in 1941. More plates would have been handled if labor had been available to break up batteries, but the shortage of manpower in this field was acute.

Flow of lead scrap through dealers' yards declined from January through May, was almost level through September, then turned upward during the last quarter. Production at secondary smelters fluctuated considerably, with peaks in January, April, and August and indications of another high point at the end of the year. Ceiling prices for lead scrap were unchanged from 1942, and newspaper quotations of dealers' buying prices showed no variation, but other reports indicated that lower prices were common.

REVIEW and OUTLOOK for MINING

Iron and Steel Scrap*

Iron and Steel Scrap Industry Duplicates Previous Record Performance.

By HAROLD E. CARMONY
HERBERT L. CULLEN
Secondary Metals Section
Bureau of Mines

THE year 1943 witnessed continuation of the diligent efforts of the scrap industry, which supplied iron and steel scrap to foundries and steel mills at a rate only slightly below the record pace established during 1942. This laudable record was achieved, in spite of the drying up of such natural sources as automobile graveyards, farm and household scrap, and peddler activities, because a steadily increasing volume of industrial scrap was being returned to consumers. Although figures for December are not yet available, it is estimated that consumers used 23,880,000 gross tons of purchased scrap during 1943, compared with 24,228,370 tons consumed in the previous year. This large tonnage of scrap was a major contributing factor in the establishment of a new production record of 79,350,534 gross tons of steel ingots and castings, since most of the added blast-furnace capacity was blown in after the middle of the year.

The importance of the role played by the scrap industry in this record production of iron and steel for the manufacture of guns, tanks, ships, and other implements of war cannot be overestimated. An index of the dealers' dependability lies in the fact that each month they shipped more scrap from their yards than they received, so that yard inventories con-

* Published by permission of the Director, Bureau of Mines, U. S. Department of the Interior.

sistently declined in spite of manpower problems.

The Bureau of Mines estimates that, in addition to the 23,880,000 gross tons of purchased scrap, some 31,362,000 tons of home scrap and 53,831,000 tons of pig iron were consumed during 1943. Approximately 1 percent less purchased scrap was consumed in 1943 than in 1942, the use of home scrap was 6 percent greater, and the quantity of pig iron used was 2 percent larger than in the previous year.

In maintaining operations at wartime tempo, consumers reduced their inventories of purchased scrap from 4,173,000 gross tons on January 1 to 3,757,000 tons on November 30, or approximately 10 percent. During the same period, stocks reported by dealers, automobile wreckers, manufacturers, and railroads declined from 1,328,000 tons to 1,139,000 tons, a loss of 14 percent. These steady drains on purchased-scrap stocks presented a gloomy picture until the middle of December, when the cancellation of certain war contracts permitted the steel companies to take some furnaces off for much-needed repairs, thereby slightly easing the raw material situation.

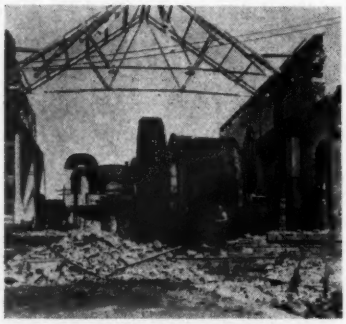
A feature of the scrap year was the utter failure of the "scrap drive," conducted during October, to produce any tangible quantity of scrap, either suitable or unsuitable for preparation. This, however, was only one of the problems faced by the scrap dealers, who produced their second largest year's business in the face of mounting difficulties.

The "junkies" had to learn from bitter experience that many draft boards refused to consider their occupation as essential, that the supply of gasoline they were able to wring from their ration boards was only sufficient to bring in easily accessible scrap, and that many new producers of industrial scrap wanted as much for their scrap as it was worth after preparation and handling in the dealers' yards.

These and other problems took their toll of smaller yards; many of the operators quit and went into war plants "for the duration" or were inducted into the armed services. They were unable, also, to meet the problem of the scarcity of the more acceptable grades of scrap, and consumers were forced to alter their furnace charges accordingly. In 1942, 18.1 percent of the total purchased scrap consumed was No. 2 Heavy Melting steel—in 1943 it was only 16.0 percent of the total. No. 1 Heavy Melting steel amounted to 17.3 percent of the total purchased scrap used in 1942—in 1943 this desirable grade accounted for only 13.4 percent of the total. Conversely, turnings and borings were more plentiful, being 15.3 percent of the purchased scrap used in 1943 and only 12.7 percent in 1942.

During the early part of the year many dealers and consuming mills reported excess inventories of alloy turnings that had accumulated because Supplementary Order M-24-c, which was issued on June 17, 1942, required the segregation of such turnings at the source, and furnace operators were loath to use them. Consequently, on March 24 an amendment to Supplementary Order M-21-a was issued, making it mandatory for consuming mills to use a definite proportion of alloy turnings in their charges. This order required that at least 8 percent of the total charge in heats of alloy steel, except stainless steel, should be turnings, and of the turnings so used at least half must be long or bushy turnings. In this manner the War Production Board hoped to utilize an ever-increasing source of alloying materials and prevent these turnings from flooding the market.

However, toward the close of the year alloy turnings were still the most plentiful grade of scrap, and the Steel Division of the War Production Board was endeavoring to ascertain whether the provisions of Order M-21-a were being complied with and whether it would be necessary to charge higher percentages of such material.



Ready for the scrap dealer

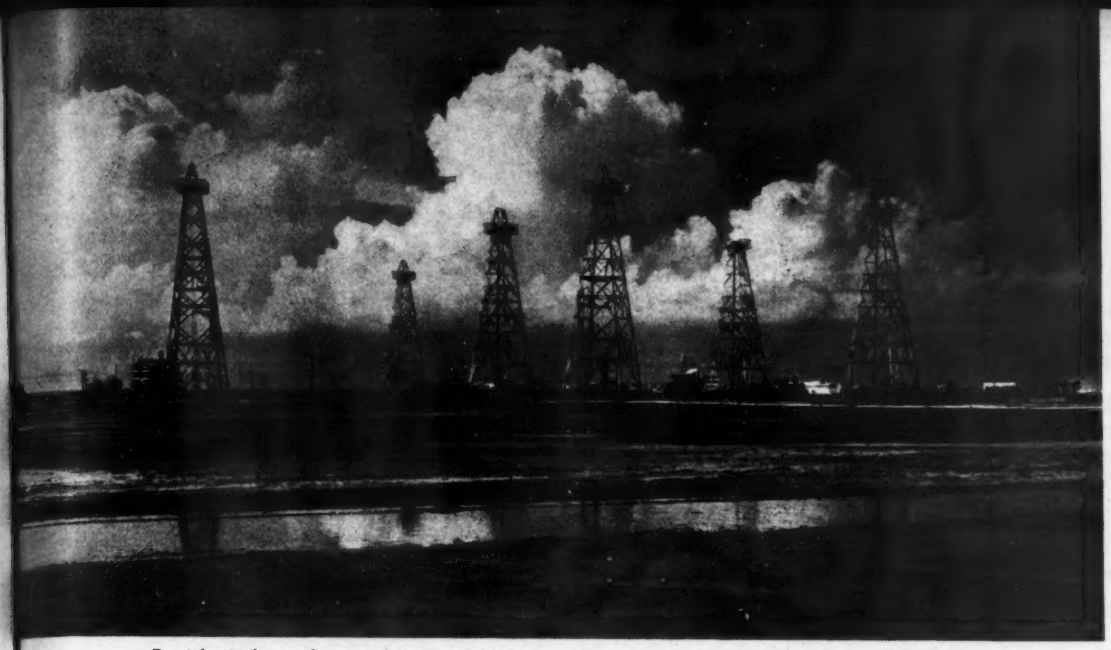
There is no question as to the value of Supplementary Order M-24-c, which required the segregation of all alloy scrap, and of Supplementary Order M-21-a. Before these orders were issued many instances were reported of large quantities of nickel-bearing turnings finding their way from the producer's plant direct to a blast furnace where the nickel content was virtually lost. After the segregation of alloy scrap was placed on a working basis, it was calculated at one time during the year that 45 percent of the nickel, 35 percent of the molybdenum, and 20 percent of the chromium present in alloy ingots was obtained from scrap, containing these elements, that was charged to furnaces. Since molybdenum was the most critical of the three elements, efforts were made to encourage the use of nickel-chrome-moly steels in order that both nickel-moly scrap and chrome-moly scrap could be used in their production.

To utilize the alloying elements present in alloy scrap efficiently, the War Production Board in September requested buyers of alloy steel to specify electric-furnace steel, since electric-furnace capacity had increased from 150,000 tons a month in 1940 to 328,000 tons in July, 1943. However, this request was withdrawn in December when the prospect loomed that so many open-hearth furnaces would become idle because of the cancellation of certain war contracts, and steel producers were thus able to utilize their open-hearth equipment for alloy-steel production.

There were no important changes in the prices of scrap during the year. Price Schedule No. 4, issued by the Office of Price Administration on April 3, 1941, had effectively pegged the prices of the steel-making grades of scrap. However, some slight changes were necessary in the case of cast-iron scrap because of the scarcity of this material. This was indicated by the constant decline in inventories of cast-iron scrap throughout 1943—from 1,022,000 gross tons of purchased cast scrap on hand at consumers' plants on January 1 to 643,000 gross tons at the end of November. To remedy this situation, slight changes in the manner of handling freight and haulage charges on this grade of scrap were made during the year to encourage the flow of the material from remote areas to sections where the shortage was acute.

Although total stocks of purchased scrap in the country have declined steadily since the end of May, the demand for scrap as a whole has also declined, and a number of the major consumers went out of the market at the end of the year. The steadiest purchasers of scrap during recent weeks have been the smaller consuming mills, which do not have integrated blast-furnace equipment and hence depend wholly on the scrap and pig-iron markets as a source of supply.

The cause of this lowered demand for scrap undoubtedly lies in the increased tonnage of hot metal becoming available from additional blast-furnace capacity. Since the most important consideration is still maximum steel production, hot metal is favored because it increases substantially the capacity of steel-making furnaces. Whether or not this increase in the use of hot metal can be economically justified on a peacetime basis is a question that has an important bearing on the future demand for iron and steel scrap.



Derricks similar to those used in the oil fields are used to drill and service the sulphur wells

"No Points Required" for Sulphur

With a year's supply in above-ground stocks, and consumption running 60 percent higher than 1939, the sulphur industry has met war demands with enviable production record.

By J. T. CLAIBORNE, JR.
Vice President
Freeport Sulphur Co.

ANNUAL SULPHUR consumption in the United States has increased about 60 percent since the beginning of the war in 1939, yet production and productive facilities have been so maintained that rationing and allocation have not been necessary in this commodity which is as vital to war as it is necessary in production for peace. In striking contrast to the necessity for allocation in World War I, in World War II the War Production Board has urged consumers to stock-pile sulphur, when transportation is available. The accumulation of such inventories at consuming points, which started before Pearl Harbor, is helping materially to ease recurrent strain on the transportation system caused by seasonal movements and the mounting stream of supplies going to all fronts.

One result of this policy of building stock piles at consuming points while transport was still available was that, for a year or two, consumption lagged behind shipments, and stocks at consuming points increased. The rail transportation system is now relieved of some of the burden as consumption is partly from these larger stocks. Shipments now lag behind consumption as stocks at consumer points are decreased. Thus, for the year 1943, sulphur consumption of representative users indicates that United States industry consumed a new record total of sulphur. Total shipments from the mines were about 3,000,000 long tons, compared with 3,121,122 tons in 1942. For the future, as water transportation again becomes available, it is to be expected that the normal relationships among shipments, consumption and stocks will be restored and each year's shipments will once again more nearly correspond to that year's consumption.

Foreign Markets

Foreign shipments to the United Nations continued throughout the year in good volume. Shipments of ground and refined sulphur were made to North Africa. Markets there for agricultural and horticultural purposes are normally supplied from Italy and Sicily. The occupation of Sicily deprived the Axis Powers of 200,000 tons per annum of sulphur formerly supplied to them from this Mediterranean island. If the industry there can be resumed under Allied control, it would not only help to restore Sicilian economy but would acticely aid in the war on the Axis, by reducing shipping formerly required for transport of sulphur from the United States.

Domestic Consumption

The uses of sulphur in war differ only slightly from those in peace. Oils

Sulphur is transported from the Grande Ecaille mine by barge to the Port Sulphur, La., shipping point

and gasoline for war planes and trucks, steel for ships and tanks, rayon for tire cord and parachute harness, take the place of oil, gasoline and steel for automobiles and rayon for apparel and fabrics of all kinds. For sulphur it means merely more of everything—more uses and more varied uses, and greater quantities.

About 70 percent of all sulphur is used as acid for peace production and somewhat more than this proportion is used for war production. One of the outstanding achievements of war production has been the organization by the War Production Board and the sulphuric acid industry of the use and re-use of sulphuric acid in the explosives manufacture. Acid for nitration of cellulose and toluene, etc., must be of high purity and high strength, and the nitration process results in spent acid of low strength. New acid is used first for nitration. The spent acid is then purified, concentrated, re-used and finally finds its way into steel pickling, fertilizer and similar end uses.

It is estimated that sulphuric acid production this past year has reached an annual rate of 8,000,000 tons of 100 percent acid. Production has been increasing steadily for the past several years, first by increasing the rate of operation in existing plants, and then by the construction of new ones. New capacity equal to 1,000 tons per day has probably been added each year for the past two or three years, and more will be needed as food production is stepped up by increased use of fertilizer.

Largely responsible for this increase are the petroleum, chemical, fertilizer and steel industries. As the petroleum industry has turned more and more to the production of aviation fuel, high quality lubricants and raw materials for synthetic rubber, more and more acid has been used for alkylation, lube refining, separation of olefines, final purification and preparation of anti-knock compounds, and the path of sulphuric acid through the industry has become complex indeed, with improved processes for re-use, concentration, and fortification all improving the utility of this versatile tool.

Adaptability has long been a characteristic of the chemical industry, and it has succeeded in meeting without faltering the heavy burden placed upon it by the war, though many materials desired for civilian use have had to be restricted to the use of the military forces. Plant capacity has been increased by more than one billion dollars, while production for 1943 has been estimated at nearly three times the pre-war figure. Much of this expansion has been in the newer synthetic organics (which none-theless require sulphuric acid), but the basic inorganic chemicals, of which sulphuric acid is one, have been more than doubled.

Among the newer and more interesting developments in which sulphur has had a part are: a new sulphonated detergent first produced last year and now 100 percent allocated to the Navy, the greatly expanded use of sulphanic acid and its derivatives for flameproofing of textile materials for the services, improved food preservation through new methods of using sulphur dioxide, and a process for treating grain flours with sulphite solutions to improve fermentation and yield a valuable by-product protein.

While the rubber industry has not in recent years taken more than ¾ percent of the annual production of sulphur, the abrupt change to synthetic rubber made necessary by the war has raised the question of sulphur requirements in this new development. The multiplicity of processes and raw materials makes exact analysis impossible, but sulphuric acid is used in the preparation of many of the raw materials by most of the processes.

Distributor for molten sulphur beginning a new storage vat

It is used in the preparation of butadiene from petroleum gases, of alcohol for butadiene whether from grain by fermentation or from olefine gases by hydrolysis, and usually enters into purification or catalysis at some stage. For Buna S, the principal synthetic being produced, sulphuric acid is used to coagulate the latex soap emulsion and about the same amount of sulphur is required for vulcanization as was used with natural rubber. Tires made from synthetic rubber use high strength viscose rayon cord because of its superior resistance to the higher internal temperatures developed by synthetic tires, and viscose rayon uses large amounts of sulphur as calcium bisulphite in preparation of the original celluose, as carbon bisulphite in the viscose reaction and as sulphuric acid in the spinning bath.

Some other synthetics use less sulphur, others use more. Thiokol contains about 70 percent and uses nearly a pound of sulphur per pound of thiokol produced. Used for some time in gasoline hose and flexable connections for its resistance to petroleum hydrocarbons, thiokol is now being applied as a latex to concrete, fabric, wood, metal, etc., to make both temporary and permanent storage tanks for oils and gasoline.

A new development of this war has been the use of wood cellulose in place of cotton linters in the manufacture of nitro cotton. The present enormous production of absolutely uniform gun cotton for the propellant charges in all shells from .30 calibre to 16-in. would have been impossible but for the highly developed art of making chemical pulp. Chemical pulp is a high purity sulphite wood pulp first produced for viscose rayon. Thus gun cotton uses sulphur first in the preparation of the wood pulp and later as sulphuric acid in the nitration step. Viscose rayon uses sulphur, as explained above, in the wood pulp, in the viscose reaction, and in the spinning bath. Rayon, which seemed once of use only in a limited way in wearing apparel, now serves by right of quality as tire cord, parachute harness, and special purpose fabric. Viscose, as cellophane, is used in such new uses as moisture-proof wrapping for airplane engines and containers for emergency equipment for airplanes, life boats, etc.

As production for war increases and as the drive on the Axis powers approaches its climax, plans for feeding the liberated peoples as well as ourselves must be the concern of the United Nations. More fertilizer and still more fertilizer is the only answer to impoverished fields and stricken farms in Europe, and to greater food needs and smaller manpower supply here at home. The War Food Administration has sponsored a huge fertilizer program designed to increase output of America's farms without use of additional labor and machinery. Carrying out this program without an extensive expansion of facilities has required an unusual practice in the fertilizer industry of continuing production at peak rate during slack seasons of the year.

Fertilizer production before the war in 1938 was 7,500,000 tons, in 1941 it had grown to 9,000,000 tons, to

REVIEW and OUTLOOK for MINING

10,000,000 tons in 1942, and in the present crop year to July is expected to be 11,000,000 tons. The Chemicals Division of the War Production Board has agreed to bring production of superphosphate up to 7,600,000 tons, basis 18 percent, by June 30, 1944. If this figure is reached, there will be at least 20 percent more superphosphate available than in the 1942-1943 season. To achieve such production, and the further increase for the next year and the next, more sulphuric acid will be required. Even when some acid becomes available from decreased explosives production, the demand for acid will continue, and sulphur will turn from the war on the Axis to the war on famine.

The sulphur industry has been able this year to fill all demands made upon it and has maintained its above ground stocks at about 4,000,000 long tons, sufficient for more than a year's supply at 1943 rate of shipments. Thus, the industry stands ready always to meet the demands for production for war, and with the return of better days, the production which has won the Army-Navy "E" award for the plants of both large producers will be continued in the interests of peace and plenty.

Minerals and Metals

(*Continued from page* 55)

based to an extraordinary degree on an expanding use of metals. To extend the trend lines of metal consumption over the past 25 years is to suggest the magnitude of peacetime demands of the future. There seems hardly any room left to supply the needs of still another war, should we be forced to face one a generation from now.

There is one additional striking fact that has been called to my attention, and that is the extent to which advancing technology in the production of war goods has called for new materials. I find 38 minerals not used in World War I vitally essential in the prosecution of this one.

The conclusion is that war or peace, we shall need increasing supplies of metal.

All these facts bring us to the conclusion that it is to national advantage to develop more natural resources. It is also to national advantage to find new technological developments, means of using lower grade raw materials, or completely new raw materials. Some of this has taken place under the stimulus of war. Magnesium today comes in abundance from sea water, underground brines, and again from one of our most abundant rocks —dolomite. Aluminum can certainly be won from clays, and I hope we can learn to win it economically, though this remains to be proved.

For example, we have greatly improved our domestic supply of vanadium, tungsten and chromite, where before we were almost completely dependent on imports. How far these may sustain free competition in the postwar era remains to be seen.

The ways and means of searching for new deposits and new technologies has in the past rested in the main upon the stimulus of private profit. It has been augmented by the very able work of the Bureau of Mines and the U. S. Geological Survey. How best to proceed beyond that is difficult to determine. On the one hand, this country is opposed to the entry of government into private business. On the other hand, industry has requested and welcomed public aid of one kind and another to a growing extent. But we have largely been dedicated to the stimulus of competition and competitive markets, and in the main we must return to this state as rapidly as postwar conditions may permit. So, it is quite apparent that these are all matters of degree. The extent to which the Bureau of Mines and the Geological Survey have functioned in the past has not alarmed the public as to intrusion into the rights of private business. Their work should clearly be intensified.

All of these questions, it seems to me, present problems requiring the most thoughtful study. They must be got at promptly. It is clearly a matter of national interest that they be answered correctly.

I am confident that they can be resolved by the vigorous cooperation of us all.

Potash Enjoys Record Year

All four of the largest producers of potash won Army-Navy E Awards during the year for excellence in production of this important war material.

By HORACE M. ALBRIGHT
Executive Vice President
U. S. Potash Company

POTASH production in the United States is a large scale mining industry, although a substantial part of the American output originates in the brines of Searls Lake, Calif., and in the great salt area near the Utah-Nevada boundary line.

However, the mines of Eddy County, New Mex., are the source of the greatest volume of potash salts being made available to the manufacturers of fertilizers and a large variety of other chemicals. Statistics are not yet available from the Bureau of Mines on the amount of sylvite and langebeinite ore mined in 1943, but it must have exceeded 3,000,000 tons.

At any rate, the output of the New Mexico mines in 1943 certainly broke all previous yearly records as did the production of refined potassic materials, and the sale and delivery of potash salts of all grades.

There are three large mining enterprises in the New Mexico potash field, all extracting ore from a Permian salt formation through shafts about 1,000 feet in depth. These are the United States Potash Company, the Potash Company of America, and the International Minerals and Chemicals Corporation listed in the order of their original appearance in the field. All three companies employ the room and pillar system of mining, undercut the potash ore bodies at their contact with the Halite—common salt, drill, blast, load and transport underground and hoist with electrically driven equipment.

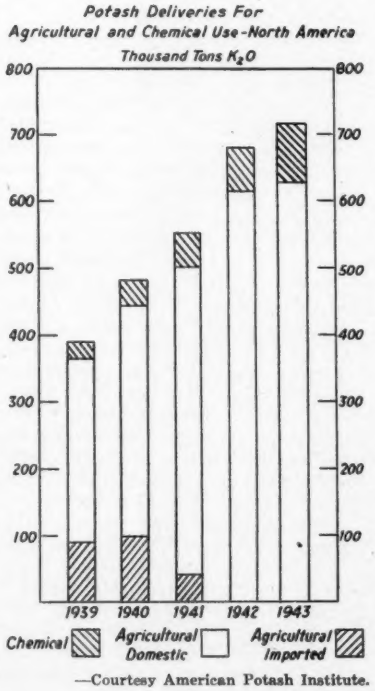
No timber is needed in the mines, and they are free of harmful gas and dust. Emphasis is laid on safety programs and appliances, and the accident records have brought high commendation from the Bureau of Mines, with several awards of the Certificate of Merit of the Joseph A. Holmes Safety Association. During 1943, there were more accidents than in peace-time, doubtless due to turn-over in manpower, but in spite of this, the safety records were highly satisfactory.

More than 2,000 men are employed in the New Mexico potash mines, mills, flotation and other concentration plants of three companies. Wages are high. The 48-hour week was in effect during most of 1943. In September, the War Labor Board brought about an agreement between company managers and union negotiating committees covering uniform wage scales for all three companies in the New Mexico field. This new potash basin wage understanding was finally approved and made effective December 16, 1943.

Nearly 2,000 more men are employed in the production of potash and other chemicals from brines in California and Utah.

The writer is not aware of any strikes in the potash industry in 1943. On the other hand, during the year, the four largest producers, including the three mining companies in New Mexico were awarded the Army-Navy "E" pennant for excellence in production of war materials by their managements and employes.

Aside from the drain of manpower from the potash mines and plants to airplane and shipbuilding operations on the Pacific Coast and to the armed forces, operations have been quite stable.



—Courtesy American Potash Institute.

The efficiency of the Mining Division of the War Production Board in making available equipment and materials for repairs and replacements has kept all plants going at maximum capacity and without time loss. Its fine work cannot be too highly commended, and the same expressions of praise are due the officials and aides in the Chemical Division who are not only concerned with operations in certain important ways but are charged by WPB Order No. M-291 with the allocation of all grades of potash products.

Order M-291 was approved February 27, 1943, and requires all prospective buyers of potash to secure allocations of materials upon showing of need based on previous use in manufacture of fertilizers and other chemicals. This order has been wisely and fairly administered and will be in effect through 1944.

An order of this kind is necessary only when the supply of a chemical is limited. That is the situation of potash. Not only has the demand for potassic materials in the chemical industries greatly increased, but the fertilizer requirements are greater than ever before in our country's history. Moreover, in 1943, Lend-lease policy dictated allocations of 18,000 tons K_2O to the United Kingdom, and there were smaller shipments that had to be made to other countries.

Two of the four large producers of potash make a very pure grade of potassium chloride which meets the requirements of the chemical industry for production of other chemicals, including many that go directly or indirectly into military items. Broadly classified in order of importance in industrial uses, the leading potassic chemicals are potassium hydroxide, potassium chloride for aluminum and magnesium production, potassium nitrate, potassium carbonate, potassium chlorate and perchlocate, xanthates, zinc chromates and yellow pigments, heat treating and anneal-

ing salts, bichromate and chemicals for gas masks.

Of course, the greatest use of potash is as a plant food, and three of the large potash producers, the American Potash & Chemical Corporation, the Potash Company of America, and the United States Potash Company maintain the American Potash Institute, an agricultural research establishment which carries on extensive scientific work in collaboration with State Agricultural Colleges and experiment stations. Recently, Dr. John W. Turrentine, president of the Institute, published a book on the potash industry which included carefully prepared chapters on production processes, including mining of potassic ores.

The reader's attention is called to the graph herewith showing United States deliveries of potash for agricultural and industrial use. Tonnages are expressed in terms of K_2O (potassium oxide).

They do not include 21,000 tons K_2O shipped to the United Kingdom and other countries. There was a shortage in potash for American agricultural use amounting to about 50,000 tons K_2O in 1943.

One potash producer has War Production Board authority and priorities for a considerable improvement of plant facilities and expansion of output. The increased production by this company and a recent arrangement between England and Spain for purchase of potash by the former from the latter, thus precluding exports from the United States should make available in 1944 enough of this material to meet the American requirements.

This means a supply in 1944 of nearly 750,000 tons K_2O, all produced in the United States. This is to be compared with only 312,201 tons K_2O produced in 1939, the year the present war broke out, and only 143,378 tons K_2O in 1933, 10 years ago. Still more startling is the comparison of the expected 1944 production of 750,000 tons K_2O with 54,803 tons made in 1918 from 128 small plants built after Germany, which before World War I held a world monopoly of potash, had cut off all exports.

The potash industry has made tremendous strides in these years of World War II, and it is believed that its performance has been a source of pride to the war agencies of the Government and the buyers and users of potash as well as to the producers themselves.

Phosphate Rock Sets New High

Production and shipments are largest in industry's history, but goals for 1944 are even higher.

By H. S. TEN EYCK
Southern Phosphate Corp.

Production Estimates

THE estimated tons of phosphate rock shipped in 1943 by producers in the United States are 5,215,000 tons. If this amount is supported by the official figures published later this year, it will mean that 1943 was the largest year in the history of phosphate rock in the United States. Of this shipment figure, it is estimated that about 275,000 tons comes from a decrease in inventories, leaving a production figure of 4,940,000 tons. This will mean that 1943 was the largest year for production of phosphate rock as well as shipments.

Following is a table showing actual figures for 1942, estimated figures for 1943, and the amount of rock requested by government agencies for shipment in 1944. All the figures shown are shipment figures and may include some material shipped from stock.

The requirement for 1944, 6,091,500 tons, means that phosphate rock producers will be required to ship approximately 1.4 times the amount the field has ever produced prior to 1943. The largest figure, other than 1943, made in 1941, was 4,915,000 tons.

Of the increase of 875,000 tons expected in 1944 over 1943, 759,000 tons is anticipated as coming from the Florida fields. It is difficult to imagine this increase in production as coming from Florida, without a material change in the labor situation as it now exists and without an increase in mining capacity.

	1944	1943	1942
Florida Land Pebble	4,007,000	3,260,000	2,893,756
Florida Soft Rock	52,000	50,000	48,470
Florida Hard Rock	40,000	30,000	70,014
Total for Florida	4,099,000	3,340,000	3,012,240
Tennessee and Virginia	1,697,500	1,600,000	1,366,335
Western States	295,000	275,000	265,665
Total	6,091,500	5,215,000	4,644,240

(All figures are in long tons.)

The bulk of the increase for 1943 and 1944 is the result of the increased and still increasing demand for phosphate fertilizers. This is the outcome of larger demands in the agricultural fields, as fertilizers have the value of increasing yields without calling for the same increase in manpower. This is in addition to the general increase in activity in the production of animals and plants for food and the plans for rehabilitation in foreign countries.

Also showing material gains in tonnage is the figure for rock to be converted to elemental phosphorus. The increase here is explained by the use of elemental phosphorus as such in the war effort, coupled with the continually increasing demand for phosphate chemicals.

Carrying a respectable percentage of the increased demands is phosphate rock treated to be consumed as a mineral supplement for animals.

Following is a table in long tons showing the tonnage distribution of phosphate rock as to its probable uses

View of recovery plant or washer showing hydroseparator, desliming tanks, etc.

in 1943 and 1944. Also shown is the percentage to be shipped by the Tennessee and Western fields and the Florida fields.

	Total U. S.	Florida Field	Percent Florida	Percent Tenn. & Western
1943				
Fertilizer	4,000,000	2,860,000	71	29
Phosphorus, Chemicals	643,000	67,000	10.4	89.6
Phosphates, Misc.	143,000	143,000	100	....
Export	429,000	270,000	63	37
Total	5,215,000	3,340,000	64	36
1944				
Fertilizer	4,586,000	3,350,000	73	27
Phosphorus, Chemicals	812,500	236,000	29	71
Phosphates, Misc.	143,000	143,000	100	....
Export	550,000	370,000	67.3	32.7
Total	6,091,500	4,099,000	67.3	32.7

Exports and Imports

The estimated tonnage of phosphate rock required for export in 1943 was 550,000 tons. Whether this figure has been met is not known. The Florida field, pebble and hard rock, has exported roughly 270,000 tons of rock. There is no data available as yet on the remainder of the tonnage. Tonnage for export in 1944 is also questionable due to fluctuations caused by changing war situations.

There are no figures available at this time for imports. However, it is known that Russian apatite and phosphate rock from Morocco and Curacao Island, Netherland West Indies, were imported during the year. The rock from Curacao Island was a low fluorine rock brought in for use in animal food. The Moroccan imports occurred in the early part of the year but were discontinued after an agreement was signed allowing England the bulk of the output from Morocco with the rest being distributed between Spain and Portugal.

Russian apatite has found a not too acceptable market in the United States due to the physical characteristics of the product.

Reserves

The reserves in the Florida field have not changed materially. Florida reserves are so large that it is thought that new methods of benefication of phosphate rock will probably be developed before the grade of the rock starts to fall any appreciable amount.

This situation is not true of the Tennessee fields. Several years ago there was a considerable shipment of 75 percent BPL grade. However, in 1943, OPA listed 72/70 BPL as the highest grade obtainable from the Tennessee field. Producers are having considerable difficulty maintaining the grades and the uniformity of grades necessary for sale to the fertilizer industry. It may be said that this field is being rapidly depleted of the grades of rock suitable for acidulation to superphosphate.

The Western field reserves have been practically untouched and in many cases are not fully prospected. They are, however, roughly one-half again as large as the Florida reserves and are being depleted less rapidly.

Mining and Washing Operations

There have been few major changes in mining operations in the phosphate fields in the year 1943. Many long-range improvement programs have been held off due to the restrictions placed on such programs by war conditions.

One change in the Florida pebble fields was the start of a movement of the Phosphate Mining Company's equipment, etc., from their present mine to Homeland, near the Peace River. The new mine is to take the place of one which is now practically exhausted.

Several producers in Florida are laying plans for minor changes, additions, etc., to provide for increased production in 1944. Some operators are negotiating with WPB for additional equipment, not only to directly increase production, but also to free

labor from one operation so that those operations now short of labor may be run to capacity.

The AAC Corporation purchased a 10-cu.-yd. dragline for its mining operations. The use of draglines to remove matrix as well as overburden continues to increase in the Florida pebble field. The matrix is dumped by the dragline at the sludge or slurry sump where it may be gunned by low pressure water and pumped to the washer. This provides a surface movement instead of pit movement of pumps, pipe lines, etc., and allows the use of low pressure water instead of high pressure water.

The J. N. Buttgenbach and Company closed down their mine in the Florida hard rock field the summer of 1943 preparatory to moving their washing and recovery plant. They expect their new plant to be opened by July of 1944. They anticipate their new location will be permanent, for 10 to 12 years, and have designed it on this basis. This is rather an innovation in the hard rock field, as most washer and recovery plant locations have previously been more temporary in nature and moved more frequently.

In the Tennessee field, the Hoover and Mason Phosphate Company has altered their recovery plant. The alterations consist mainly of the change in method of introducing the phosphate muck to the plant and changes in their flow sheet. The net effect has been to increase the efficiency of their recovery operations and to eliminate many of the material handling problems they previously experienced.

It is understood that the International Minerals and Chemicals Corporation plan to increase its output of phosphate rock. They have leased a substantial area of phosphate land in Montana and are proceeding with plans to open a mine at that location. It is difficult to predict when they will commence actual mining operations because of war-time restrictions of certain essential machinery and equipment.

Developments in the Processing and Chemical Treatment of Rock

While the developments in the mining, benefication, and recovery of phosphate rock have not been startling this year, there has been considerable activity in the mechanical and chemical treatment of the rock.

Ground Rock

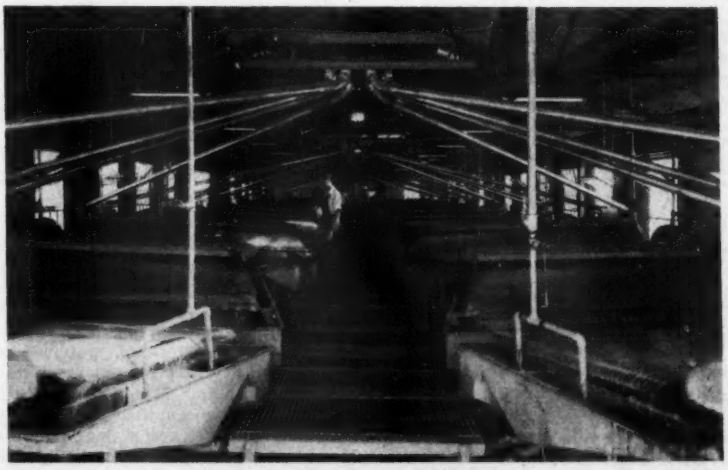
The shipment of triple superphosphate by lend-lease to England and the diverting of Tennessee phosphate production directly to the war effort, have taken away a good bit of the fertilizer previously distributed through the AAA program. This has been partially replaced, especially in the Middle West, by ground phosphate rock for direct application to the soil. Local shortages of superphosphate have also resulted in the increased use of ground rock. Many small acidulators of phosphate rock have been buying their rock from the producer, already ground. In addition to all of these increased uses of ground rock, there has been, in particular sections of the United States, a slow but steady increase in the amount of ground rock used by direct application to the soil. As a result, several phosphate rock producers have installed grinding mills or increased their grinding capacity.

Phosphate Feeding Supplements

The amount of phosphate rock consumed in the form of a mineral supplement for swine, poultry, and cattle food, has increased tremendously. It is estimated that about 150,000 tons of rock will be used as a source of calcium and phosphorus for animals. This is due primarily to the shortage of bone meal brought on by war-time conditions, an increase in livestock production, and the substitution of vegetable meals for high phosphorus animal and fish meals.

There are three types of phosphates used in these mineral supplements. They are defluorinated phosphate rock, defluorinated superphosphates, and mono and di calcium phosphates prepared by chemical treatment of phosphate rock. An interesting development within the mining industry is the tendency of the miners themselves to go into these new outlets with their own production facilities. It shows a growing realization on the part of the rock producer for the necessity of broadening his outlets.

Defluorinated superphosphate at present represents the bulk of the tonnage of this material other than such bone meal that is available. However, some producers feel that the product to be offered to the feed industry should be one more certain of a more secure position in the post-war markets and are doing considerable work along this line.



Modern table plant flotation of phosphate rock away from sands

REVIEW and OUTLOOK for MINING

Phosphorus and Chemical Phosphates

The amount of rock used for elemental phosphorus has grown as fast as electric furnace capacity can be increased. This increasing activity centers in the Tennessee field and is brought on mainly by war demands. There is, however, a continually growing normal market for chemicals made from elemental phosphorus.

The consumption of rock treated by the wet process has increased to the full capacity of the wet processing plants. No additional plants have been built as yet for the production of chemical phosphates due to wartime restrictions. Some plants, however, have increased their capacity by changes in their chemical flow sheets. One of the major developments in this field has been the introduction of the Lurgi and the Oliver Sand Table Filter to filter and wash the slurry direct from the digestion rather than the usual method of using the counter current decantation process.

Fertilizers

The production of superphosphate amounted in 1943 to roughly 7,000,000 tons (18 percent P_2O_5 basis) including 275,000 tons of triple super. This is 1.35 times as much superphosphate as was produced in 1942. For 1944, it is estimated that the tonnage of super-

Typical dragline removing overburden

phosphate required will be (on a 18 percent basis) 8,150,000 tons. It is interesting to note that this is practically twice the amount of superphosphate produced in the United States in 1941. Some members of the War Food Administration feel that this figure should be raised closer to 9,000,000 than 8,000,000.

This higher tonnage is to be met by some increase in capacity, operating present plants at full capacity, and starting up several small acidulating plants that had discontinued operations. The problem at present is to provide enough sulfuric acid for the acidulators. Spent ordnance acid and spent acid from high octane gasoline refineries is being shipped to acidulators as fast as transportation difficulties are overcome. There is also a prospect of a 300-ton oleum plant being built in Baltimore by Standard Wholesale and Fertilizer Company.

Although it has not as yet been officially announced, it is thought that a triple superphosphate and straight superphosphate plant may start construction in the near future. In all probability, such a plant will be located near a source of spent sulphuric acid, probably in the South or Southwest, where many of the ordnance plants and oil refineries are located. It is estimated that this plant will have a capacity of approximately 400,000 tons a year on the basis of 18 percent P_2O_5 superphosphate.

Phosphate rock shipments in 1943 will be roughly 17 percent greater than in 1942. In 1944, production will be roughly 31 percent more than 1942.

There were few major changes in washing and mining operations in 1943 but producers are making some changes and additions to increase production in 1944.

The export and import market was and will be extremely unsettled due to wartime conditions.

Superphosphate production, while materially increasing in 1943, calls for a still larger increase in 1944.

There has been considerable activity in the phosphorus and chemical phosphate field. Miners are endeavoring to broaden their markets.

Phosphate rock industry, while experiencing its largest year in history in 1943, must prepare to produce an even greater amount in 1944.

Silver

(*Continued from page* 77)

elsewhere makes necessary the redistribution of some of the gold and silver reserves that are now stored in the United States. No doubt our Government will welcome an opportunity to distribute liberally its precious money metals reserves among friendly nations with whom we desire to reestablish trade.

There are many economists, particularly in Great Britain, who do not share with American economists and bankers the opinion that gold and silver are essential to a sound currency. Indeed, there are some American economists and bankers who are disposed to discredit the important role of silver as backing for our paper money. And yet these currency experts can offer no valid reason to substantiate their contention. Nor can they point out, with any degree of conviction, wherein silver-backed certificates and silver dollars have in any way proved detrimental to our currency system.

Some form of international bimetallism in the post-war world must be established if sound currency systems are to be restored on a sound basis in foreign countries. The use of silver along with gold in the settlement of international balances will minimize manipulations and afford greater protection to currency exchange values of the weaker nations. Why is it not reasonable to assume that a currency system based on both gold and silver, such as the system in the United States, would be the most logical, the most substantial and the most acceptable for any other country? It is inconceivable how any person well informed on currency matters could hold that a paper note is superior to a silver dollar or to an equivalent amount of silver bullion. Yet, such a contention is occasionally voiced.

The wages of more than half of the people of the world are so small as to make difficult and illogical the utilization of gold alone in the payment of their compensation. Silver offers to them the only acceptable means of payment. Furthermore, when we consider that a very small percentage of the people of the world have bank accounts, we realize the hardships that would be imposed on the remaining masses, whose average daily wage is only a few cents in our money, if required to accept and to store away irredeemable paper notes. The distrust of paper money will be reflected in the demand for gold and silver backed currencies; and this demand must be met.

The world has suffered and is still suffering from the misuse of paper money. Values cannot be maintained for any appreciable period where they are based on paper promises. Stability can be achieved only where the precious metals (gold and silver) are used as a measure of values.

Miscellaneous Minerals

(*Continued from page* 88)

from Vermont and from the Georgia-Carolina area is entirely adequate to supply the demand for fillers in such products as roofing compounds, paper, and rubber.

Some two months ago the supply picture on block talc was critical. However, increased imports and the availability of large supplies from new foreign sources have relieved this critical condition and promise to supply material not only to satisfy current requirements but also to accumulate an authorized Government stockpile.

Tests are now being conducted on domestic block talc from California. If these are successful, reserves from that source are probably sufficient to supply all block talc requirements. An additional source exists in Montana where small amounts of material of proven quality are being produced. Should Bureau of Mines exploratory work now being conducted prove the existence of larger reserves of ore, this Montana source can further augment the supply position.

Fluorspar

By H. T. MUDD

Chief, Fluorspar Section, Mica Graphite Division,
Minerals Bureau, War Production Board

FLUORSPAR, though annual production is small by comparison with most other minerals, is an exceedingly important constituent of several essential war materials such as insecticides and refrigerants. It is also used in the process of making steel, aluminum and high octane gasoline, which, without it, could not be produced with the efficiency or in the quantities needed to meet the varied needs of war. During 1943, the domestic producers were called upon to supply an unprecedented quantity. Production slightly exceeded 408,000 tons while consumption was approximately 386,000 tons. Stocks, therefore, after adding net imports, were increased by a substantial tonnage.

The Illinois-Kentucky field continued to dominate the industry; but, as a result of high prices, production from the west increased sharply over 1941, the last pre-war year; and in 1944 the west will probably continue to increase its percentage of total output. Although a small increase in acid grade producing facilities is necessary in 1944 to meet the expanding needs of the chemical industry, the United States is now capable of providing essentially all of its fluorspar requirements.

Since the three principal grades of fluorspar, metallurgical, acid and ceramic are essentially not interchangeable from the point of view of use, and, since the problems and developments in 1943 and the outlook for 1944 are different, each will be reviewed separately in more detail in the succeeding paragraphs.

Metallurgical Grade

At the start of 1943, the rate of consumption considerably exceeded the supply, and requirements were therefore being met partly out of stocks. About the middle of the year, however, the picture began to improve and, currently, domestic production, exclusive of imports, is exceeding the steel industry's rate of use. The principal factors which contributed to this improved position are:

1. On July 1, a general wage increase was granted by the WLB to the employes of the Illinois-Kentucky operators. This increase corrected the relatively low wage level which had existed in the area, and the supply of labor substantially improved during the second half of the year.

2. On the same day that the wage increase was made effective, the OPA increased prices for all grades of fluorspar by approximately $5 per ton. This increase was granted, in part to compensate for the wage increase, and also to stimulate prospecting and development. Production increased sharply in the following months.

3. A voluntary effort by the steel industry to conserve fluorspar had exceedingly important results. Whereas, at the beginning of the year, the rate of consumption per ton of basic open hearth ingots produced was approximately 6 pounds per ton, the rate of consumption now is more nearly 5 pounds per ton. Furthermore, the steel industry, through the cooperation of OPA and the Steel Division of WPB, is now using a lower quality of fluorspar and, consequently, ore reserves and production have increased.

4. A number of new projects for mine development and mill construction were initiated during the year, part of them by private capital as a result of the stimulation of higher prices, and part of them by Government financial assistance. This assistance took the form of Metals Reserve Company purchase contracts, Reconstruction Finance Corporation, Defense Plant Corporation, and Metals Reserve Company financing and Access Road construction.

5. As a result of the efforts of the Foreign Economic Administration, formerly the Bureau of Economic Warfare, great progress has been made in the development of foreign sources for import, and the tonnage received greatly exceeded that in previous years. All imports are now being placed in Government stockpiles.

6. Much credit is also due the United States Geological Survey, the Bureau of Mines and the Illinois Geological Survey. These organizations maintained large staffs in the field, and a number of worthwhile areas were prospected and new reserves developed. Considerable assistance was also rendered to private companies in the planning of their prospecting and development programs.

Currently, the rate of domestic production and importation is such that the country's depleted stocks are being built back to a safe level. Furthermore, it seems likely that this condition will continue throughout 1944, and that, by the end of the year, stocks of metallurgical fluorspar will be high enough so that no wartime emergency need or supply deficiency could seriously effect the steel industry. It is, in fact, possible that some price softening will take place during the year and that the quality of metallurgical fluorspar being used by the steel industry will be forced back to the pre-war specifications.

Acid Grade

During most of 1943, acid grade fluorspar was reasonably plentiful; stocks were increased during the year and now stand at an all-time high level. The aluminum and chemical industries consumed nearly 45 percent more than in 1942 and about 115 percent more than in 1941.

At the present time, the supply of acid spar is approximately in balance with requirements, but in spite of cutbacks by the aluminum industry, consumption will probably continue to expand in 1944 as a result of increased use by the chemical industry. Production of high octane gasoline, insecti-

(*Continued on page* 127)

SALIENT STATISTICS OF FLUORSPAR IN THE UNITED STATES, 1939-1943, IN SHORT TONS

Year	Production	Shipments from mines to— Domestic consumers and Metals Reserve Co.	Shipments from mines to— Foreign consumers	Imports	Consumption	Stocks at end of year Industry (Consumers and producers)[1]	Stocks at end of year Government stockpile	Stocks at end of year Total
1939.....	173,000	179,795	2,976	16,302	176,800	129,019	.....	129,019
1940.....	244,000	225,118	8,482	11,873	218,500	145,966	.....	145,966
1941.....	313,000	308,485	12,184	[2] 7,311	303,600	140,897	.....	140,897
1942.....	337,000	351,300	9,016	([3])	360,800	116,437	.....	116,437
1943.....[4]	408,000	396,000	10,000	([3])	386,006	127,000	40,000	167,000

[1] Finished fluorspar only. [2] January to September, inclusive. [3] Publication of import statistics was suspended beginning October 1, 1941. [4] Figures for 1943 are partly estimated and subject to revision.

47 STROKES EVERY 60 SECONDS

● If you are contemplating the purchase of a mechanical loader, make a detailed investigation of the latest Whaley "Automats." Learn why Myers-Whaley loaders stay in service so long. Some of them have been in use for over 20 years.

The "Automat" is the only loader available with that natural, smooth running, automatic shoveling head. Shovel operates at the rate of over three-fourths of a complete stroke per second; is almost four feet wide and handles tremendous lumps of coal without batting them around. No dragging of coal . . . no dragging friction of loading mechanism . . . no crushing or unnecessary breakage of coal.

The loading head is the "business end" of any loader. All other loading functions of a machine, regardless of their individual efficiency, depend upon that loading head for their effectiveness. It's this loading head you are most interested in for production—don't overlook it. Since its inception—over 35 years ago as the first commercially successful mechanical loader—this shoveling principle of loading has been brought to its highest point of efficiency, the proved results of which have made the Whaley "Automat" so much in demand today for maximum production at the lowest cost per ton of material handled.

Then, bear in mind that only one 25 H.P. motor is required to operate the "Automat." This means worthwhile savings when compared with other machines of equal capacity that use double or more than the power requirement of the Whaley "Automat."

Write for complete information
MYERS-WHALEY COMPANY
Knoxville, Tennessee

● The five illustrations at left show the vertical shovel motion of the "Automat" . . . the feature that makes this machine the safest loader known. The action photos from top down shows Shovel head moving in under material, carrying it back for deposit on front conveyor and immediately, shovel starts its return for another shovel load of coal . . . all of which occurs within approximately one second, or 47 strokes per minute.

MYERS-WHALEY

★ ★ ★

Mechanical Loaders Exclusively For Over 35 Years

Splicing Mining Cables Manufactured With Synthetic Materials

A Report of the Power Committee

By E. W. DAVIS
E. G. STURDEVANT
J. H. SIMPSON

THE SHORTAGE of natural rubber under wartime conditions has resulted in the necessity of using wires and cables for the mining industry made from other types of material now available such as synthetic polymers of the thermosetting or thermoplastic types. The resulting cables from outward appearances resemble those previously available, but do bring up certain field problems in their use and maintenance that are of great importance to mine operators.

The operating conditions for mining service are mechanically severe and continuity of service is essential; therefore, mining operators must have available the necessary information on repairing and splicing such cables in order to maintain this continuity. The following information has been assembled for the purpose of aiding the industry and it is hoped to be of sufficient clarity and completeness to accomplish its purpose.

New type cables utilizing thermosetting materials are close facsimiles for previous cable, but in general have for insulation the Buna S synthetic type rubber compounds and Chloroprene (Neoprene) jackets. There are also available Buna S insulated, fabric covered cables as alternatives. Thermoplastic synthetic cables are usually insulated and jacketed with polyvinylchloride (PVC) or similar polymers, although they may be furnished with synthetic insulation and weatherproofed fibros covering.

The committee has obtained from various sources a general story and picture of the available splicing materials for these cables and has done some experimental work in determining the best methods of handling them.

It is the general field practice of mining operators to repair or splice damaged or broken cables. Two general methods are used in repairing insulations and jackets—(1) cold wrapped, and (2) vulcanized.

For those operators who use vulcanized joints there is available equipment for accomplishing the vulcanization after the repair or joint has been put together. Probably the simplest way of illustrating the changes necessary is to give, as has been done below, the past methods of accomplishing necessary work on cables and to compare it directly with the changes essential to good work with the present available types of cables and splicing materials.

Materials

The necessary materials for repairs in the past have consisted of—

1. Rubber cement.
2. Rubber insulating splicing tape.
3. Hard service rubber jacket splicing tape.
4. Friction tape.
5. W.P. paint.

At the present time rubber cements are available for use with rubber splicing tape; some changes may be necessary to allow their use with synthetic tapes of the thermosetting types such as Buna S and new cements will be required for use with Neoprene and PVC synthetics. The following list is offered as a guide, but it is not intended that this be restrictive or complete as other combinations or materials are undoubtedly available and usable.

Type of Cement	Use
Rubber	Rubber to rubber
Rubber	Buna S to rubber
Rubber	Buna S to Buna S
Rubber	PVC to rubber
Neoprene	Neoprene to neoprene
Neoprene	Neoprene to rubber
Neoprene	Neoprene to Buna S

Rubber insulating tapes are available under WPB limitations as to crude rubber content. They are serviceable but in some cases have given trouble in the vulcanized type of repair or joint due to failure to cure properly. Care should be taken to select a vulcanizable tape.

Considerable work is being done on insulating tapes made from Buna S, and splicing tapes of this type are on the market in limited quantity. Future development will be toward better tapes of this type which will no doubt gradually replace and eliminate natural rubber tapes. Bune S insulating tapes may be stored for normal lengths of time without trouble.

Insulating Splicing Tapes

Type of Tape	Use
Buna S	Buna S to rubber
Buna S	Buna S to Buna S
Buna S	Buna S to tough rubber jacket
Buna S	Buna S to neoprene
WPB rubber	As above

Jacket Splicing Tape

Neoprene	Tough rubber to neoprene
Neoprene	Neoprene to neoprene
PVC	PVC to PVC

Hard service rubber jacket tape as previously furnished will not be available, or if available now will be procurable in decreasing quantities. In their place Neoprene tapes, combination of Neoprene and Buna S, and use of insulating tape for outer jackets will be necessary. Care must be taken in ordering Neoprene tapes since their storage life probably will be short, much shorter than for natural rubber or Buna S tapes. It is not felt that Buna S hard service jacketed tapes will be produced in the immediate future.

Extensive experimental work has been carried out with available cements and tapes, using ordinary rubber cements; either cold wrapped or vulcanized joints can be made in the insulation between—

(a) Rubber insulation and WPB rubber tape.

(b) Rubber insulation and Buna S tape.

(c) Buna S insulation and Buna S tape.

(d) Buna S insulation and WPB rubber tape.

Standard procedures in every case were followed.

With jacket tapes, experimental work indicates satisfactory jacket repairs of the vulcanized type can be made using Neoprene tapes and Neoprene cements between—

(a) Tough rubber and Neoprene tape.

(b) Neoprene and Neoprene tape.

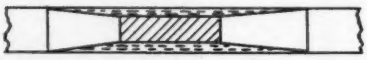
(c) Tough rubber and Buna S insulating tape.

(d) Neoprene and Buna S insulating tape.

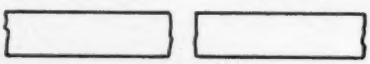
In general, cold wrapped repairs or joints are not as satisfactory as vulcanized ones for mine usage. However, the above combinations can be applied and will give workable results with standard joining and splicing technique.

The following typical splicing methods cover the standard practice for rubber cables and the necessary modifications for new cables and materials.

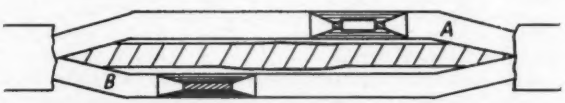
DIRECTIONS FOR REPAIRING SINGLE CONDUCTOR CABLES

For Rubber Cables	For Synthetic Cables
	
1. Damaged insulation removed.	Same.
	
2. Insulation scarfed or penciled. Length of scarf 4 to 5 times rubber thickness. NOTE: A sharp knife slightly moistened with water will facilitate making the scarf.	Same.
3. Clean scarf and cable for 1 in. beyond scarf, preferably with carbon tetrachloride, and coat cleaned surfaces with cement.	Use cements as indicated under "Materials."
4. Allow cement to dry and become "tacky."	This is important with synthetic tapes and cements.
	
5. Apply recommended splicing tapes between scarfs to a thickness slightly greater than that of the original insulation and jacket.	Use splicing tapes as indicated under "Materials."
6. If repair is unvulcanized, apply friction tape with ½ lap to 2 in. beyond ends of repair and apply a waterproof paint.	Same.
7. If repair is vulcanized, cure in heated mold of vulcanizer.	Same.

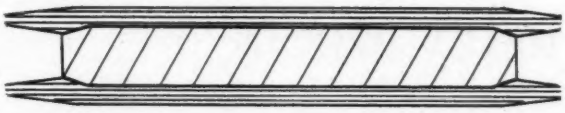
DIRECTIONS FOR SPLICING SINGLE CONDUCTOR CABLES

For Rubber Cables	For Synthetic Cables
	
Cables to be spliced.	Same.
	
1. Conductor spliced.	Same.
	
2. Insulation scarfed or penciled. Length of scarf 4 to 5 times rubber thickness. NOTE: A sharp knife slightly moistened with water will facilitate making the scarf.	Same.
3. Clean scarf and cable for 1 in. beyond scarf, preferably with carbon tetrachloride, and coat cleaned surfaces with cement.	Use cements as indicated under "Materials."
4. Allow cement to dry and become "tacky."	This is important with synthetic tapes and cements.
	
5. Apply recommended splicing tapes between scarfs to a thickness slightly greater than that of the original insulation and jacket.	Use splicing tapes as indicated under "Materials."
6. If repair is unvulcanized, apply friction tape with ½ lap to 2 in. beyond ends of repair and apply a waterproof paint.	Same.
7. If repair is vulcanized, cure in heated mold of vulcanizer.	Same.

DIRECTIONS FOR REPAIRING AND SPLICING MULTI-CONDUCTOR CABLES

For Rubber Cables	For Synthetic Cables
	
1. Open cable and remove damaged insulation. (If cables are shielded split shield and tie back out of the way for further use.) Cut all conductors to exactly the same over-all length between the ends of the cable jackets but in such manner that the conductor joints are staggered as shown. Splice conductors as in conductor "A" where necessary.	Same.
Ground conductors if present	Same.

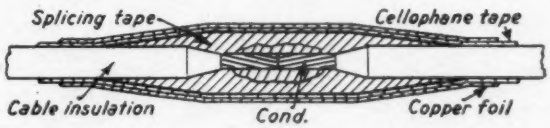
Rubber Cables	Synthetic Cables
should be spliced and the splice covered with friction tape.	
2. Scarf insulation as shown. Length of scarf 4 to 5 times thickness of insulation. NOTE: A sharp knife slightly moistened with water will facilitate making the scarf.	Same.
3. Clean scarf and cable for 1 in. beyond scarf, preferably with carbon tetrachloride, and coat cleaned surfaces with cement. Allow cement to dry and become "tacky."	Use cements as indicated under "Materials." This is important with synthetic tapes and cements.
4. Apply rubber tape between scarfs. For repaired or spliced conductors, make diameter over repair slightly greater than that over the original insulation.	Same.
5. If splice or repair is unvulcanized, apply one layer of friction tape ½ lap. If cable is shielded type, replace conductor shields.	Same.
6. If splice is vulcanized, cure in heated mold of vulcanizer.	Same.



7. Pull conductors together, lay jute fillers in interstices and apply one layer of friction tape. Replace over-all shield if present.	Same.
8. Scarf jackets, length of scarfs 4 to 5 times thickness of jackets. NOTE: A sharp knife slightly moistened with water will facilitate making the scarf.	Same.
9. Clean scarf and cable for 1 in. beyond scarf, preferably with carbon tetrachloride, and coat cleaned surfaces with cement.	Use cements as indicated under "Materials."
10. Allow cement to dry and become "tacky."	This is important with synthetic tapes and cements.
11. Apply rubber jacket tape between scarfs until thickness is slightly greater than that of the original jackets.	Use tape as indicated under "Materials."
12. If repair or splice is unvulcanized apply one layer of friction tape (½ lap) over all and paint with a waterproof paint.	Same.
13. If repair or splice is vulcanized cure in heated mold of vulcanizer.	Same.

SPLICING THERMOPLASTIC INSULATED CABLE

Heated-foil Wrapped Method



This method is recommended in preference to the rubber-tape method, where oil resistance is the prime consideration.

1. Splice the copper conductors together in the conventional manner used for rubber-covered cable.

2. Pencil down the ends of the insulation for a relatively long distance.

3. Roughen the surface of the insulation and tapered ends to which splicing gum is to be applied, with a rasp or other suitable tool.

4. Apply thermoplastic splicing tape with ¼ lap to a thickness 50 percent greater than the insulation thickness. Seal the end of the gum with a moderately warm iron to prevent unraveling.

5. Apply tightly, a layer of cellophane, half-lapped over the entire surface of the splice.

6. Apply a layer of copper foil over the cellophane.

7. Heat with an alcohol lamp (small wires) or blow torch (larger sizes) sufficiently long to bond (300 F.). Do not overheat.

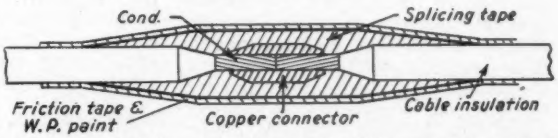
8. Allow to cool. Remove copper foil. Cellophane may be left in place, but in no case should it be removed before the splice has cooled.

9. Apply a layer of friction tape, half-lapped over the splice.

10. Paint with waterproof coating.

SPLICING THERMOPLASTIC INSULATED CABLE

Rubber-tape Method



This method is preferable to the foil-wrapped method, where moisture, but not oil or acid, is to be encountered.

1. Splice the copper conductors in the conventional manner used for rubber-covered cable.

2. Pencil down the insulation for a relatively long distance.

3. Smooth the taper and insulation adjacent to the taper with sandpaper.

4. Coat the entire surface to which splicing gum is to be applied with rubber cement. Allow to dry.

5. Build up with rubber of Buna S splicing tape with ¼ lap to a wall thickness of 50 percent greater than the insulation thickness, and carry the tape to a point about 1 in. beyond the shoulder of the taper or either side of the splice.

6. Apply a layer of friction tape. For further protection, paint with waterproof coating.

A thermoplastic sheath over insulated conductors can be spliced as described above after the insulated conductors of the cable have been spliced together in the customary manner.

(*Continued on page* 117)

Colorado's hospitality was at its best at the traditional "Silver Dinner"

Western Mining Industry Meets

WESTERN mining men, gathered in Denver for the joint meeting of the Western Division of the American Mining Congress and the Colorado Mining Association on January 27, 28 and 29, held spirited discussions of the industry's problems and climaxed the three-day session with a vigorous declaration of their views on public policy. Highlights of the program included discussions of the present status and outlook for the principal metals, mining manpower, mineral policies of the War Production Board, metal prices and quotas, the proposed mineral stockpiling program, the gold mines' problem, mine taxation, tariffs and international trade, and the problems of developing mineral reserves for the future.

Registration at the Conference totalled nearly 900, with a splendid representation of executives and operating officials from all the Western states, and interest in the discussions kept the meeting room filled to capacity. All wanted to hear the industry spokesmen express their views as to what the future holds, and what is required to maintain a sound mining industry capable of supplying war needs and functioning efficiently in the post-war period. The fine cooperation of the various speakers from the war agencies, Army and Navy was greatly appreciated by the mining men, and the Government representatives undoubtedly obtained a closer understanding of Western mining problems and a better knowledge of the operators' point of view.

Western Secretaries' Meeting

Secretaries of all the Western mining associations met the day preceding the Conference for an informal discussion of association activities in connection with local and national mining problems. This get-together was inaugurated at the 1938 meeting of the Mining Congress in Los Angeles and has become an important feature of the industry's annual meeting.

A heavy snow-fall on the opening day disrupted train schedules and the late arrival of some speakers occasioned minor shifts in the announced program. Otherwise, the snow only served to remind the crowd of the Mining Congress' last meeting in Denver, in September, 1936, when they were greeted with an unusually early snow. The meeting opened with a brief business session of the Colorado Mining Association under the chairmanship of President Charles N. Bell, at which the annual report of Secretary Robert S. Palmer was presented, and a strong statement of policies by the Resolutions Committee was duly approved. This was followed by timely discussions on the Role of Light Metals in the Post-War Economy, by Paul P. Zeigler, Reynolds Metals Company; Fluorspar Deposits—Their Geology and Exploration, by James Steele Williams and Doak C. Cox, U. S. Geological Survey; and Pegmatite Deposits (Mica, Beryl, Tantalum) of Colorado-New Mexico, by Richard H. Jahns and J. B. Hanley, also of the Geological Survey.

The welcoming luncheon on the opening day was presided over by Robert M. Hardy, chairman of the A. M. C. Western Division, following introductions of distinguished guests by Harvey L. Tedrow, chairman of the General Committee for the Colorado Mining Association. Dr. H. C. Parmelee, editor of *Engineering and Mining Journal*, had agreed to "pinch-hit" as a speaker for Senator Pat McCarran of Nevada, who was detailed in the East by the death of Senator M. H. Van Nuys. Discussing the pent-up demand for metal products that will have to be satisfied after the war, and pointing out the relatively minor role that plastics can play, Dr. Parmelee gave an encouraging picture of the future for min-

A DECLARATION OF POLICY

★ ★ ★

*THE WESTERN DIVISION OF THE AMERICAN MINING CONGRESS, assembled in annual meeting, Denver, Colo., January 29, 1944, declares its views upon the following matters of public policy:**

★ ★ ★

PROSECUTION OF THE WAR

The mining industry has been called upon to supply in unprecedented amounts the basic minerals and metals vital to Victory. Needs have been met and war production has not been hampered by lack of mineral raw materials.

We pledge our continued cooperation to the winning of total Victory and to the establishment of a sound peacetime economy when the war is won.

FREE ENTERPRISE

Free, private, competitive enterprise—by whatever name it is called—is the basis of the American way of life. It has brought to America the world's maximum industrial production and highest standard of living.

Free, private, competitive enterprise requires:

The highest degree of personal freedom attainable under just laws impartially enforced.
Preservation of the incentive system.
Freedom to save and invest as we wish.
No arbitrary control by government.
The preservation of property rights.
Private, not government ownership.
No special privileges—for management, for labor, for capital.
Government by law and not by bureaucrats.
Retention of the sound principles voiced by the Declaration of Independence and the Constitution including the Bill of Rights.
No war economy after the war is over.
The acceptance of competition for ourselves as well as for others.

Under this system—to which we wholeheartedly subscribe—American Industry, once the problems of conversion are fairly solved, can move forward with confidence, develop new frontiers through technical and scientific progress, and produce and distribute better goods in greater volume at lower prices to more people.

Only under a system of free, private, competitive enterprise can we restore and preserve individual freedom.

EMPLOYER-EMPLOYE RELATIONS; MANPOWER

Prosecution of the war demands continued mine production at an adequate level uninterrupted by labor disputes and unhampered by a deficiency in manpower.

We have heretofore declared our belief in collective bargaining. Disputes have been reduced to a minimum and have not impaired production from the mines. Mine operators have cooperated with government agencies in resolving peacefully such disputes as have occurred. We reiterate our previous declaration that governmental determination of disputes should be impartially administered.

Manpower deficiencies in the industry can be met with less difficulty through recognition by manpower authorities that the mining industry has for years pursued the policy of improvement of working and living conditions and that the operators, when confronted during the emergency with unexpected demands for metal beyond projected capacity, have cooperated to the fullest extent in maintaining attractive wage, living and working conditions.

CUTBACKS AND CANCELLATIONS

We recognize that premium price payments and special Metals Reserve contracts have contributed substantially to the production of essential metals that were in short supply. We also recognize that as stockpiles of these metals accumulate, adjustments and cancellations of such agreements will occur. We believe that cancellations or adjustments should be made on a basis which will return to the producer his cash outlay in undertaking such production together with a reasonable profit.

IMPORTS

The mining industry recognizes that the purchase of foreign metals has been essential, but opposes the payment of higher prices for foreign metals than for domestic production except when of vital importance to the preclusive buying program. All domestic production should be allocated and utilized before imports are distributed.

STOCKPILES

It is of vital importance to the national economy and to national security that surpluses of primary and secondary minerals, metals, alloys and scrap be frozen in the hands of the government following the termination of hostilities, as a permanent reserve against a possible future military emergency. These stockpiles should include metals and minerals received through reverse lend-lease and from unexpired foreign commitments.

Provision should be made for the augmentation of such stockpiles, to the extent that the Army and Navy consider such increase necessary for national safety, and with preference given to domestic sources of production.

Stockpiles thus created should be held intact and not released except by act of Congress.

TARIFF

The need for adequate mineral and metal production from the mines of the United States in time of national emergency has been forcefully demonstrated in the past three years. To protect our nation against any future threats to its security, and to permit continuation of a basic industry essential to the economy of the West, our mines must of necessity be kept in

* Following adoption by the Western Division, American Mining Congress, this declaration was unanimously endorsed by the Colorado Mining Association as representing also the policies and program of that organization.

good operating condition, future reserves must be developed to the fullest extent possible, and new exploration must be encouraged. While the mining industry, in the interest of national and world prosperity, favors maximum international trade in time of peace, such trade must not be stimulated at the expense of national security. Domestic mines must be protected by a tariff adequate to offset richer natural deposits and lower costs in foreign countries.

PUBLIC LAND POLICY

We oppose any expansion of the Government leasing system to cover public lands valuable for their metal content, and to exact royalties from and extend the bureaucratic control of the General Land Office over the free enterprise of prospectors and locators who for nearly a century past have been responsible for the discovery and production of the valuable metal resources which have been the basis of our industrial development. Federal recording of location notices and proofs of annual labor should not be required.

We urge discontinuance of the present policy of the General Land Office in protesting applications for mineral patents in mining regions, and the technical and unreasonable requirements as to demonstrated mineral values prior to full development of the properties where the location of claims with respect to proven lodes and ledges is such that no reasonable doubt of this value for mineral purposes can exist. In this connection we urge a return to the former policy of encouraging the development of properties in such proven mineral areas through the liberal granting of patents.

We oppose the assumption by the General Land Office of the right to investigate and pass on the validity of metal mining locations before any application for patent is made. This is an unauthorized bureaucratic invasion of the miner's long-recognized statutory right to locate mining claims upon the unreserved public domain wherever the locator believes metals may be found in paying quantities.

GOLD MINES

We urge that Order L-208 of the War Production Board suspending operation of gold mines be rescinded at the earliest possible date, and that in connection therewith a just and liberal policy with regard to priorities and manpower be adopted in order that the industry may gradually get into production.

Until this can be done we urge that the War Production Board give favorable hearing to the cases of individual mines requesting permission to operate and produce on a basis which will return maintenance costs.

We favor suitable legislation to permit deferment of contract obligations of mines which are forced to suspend operations by government edict.

A healthy domestic mining machinery industry is essential to the welfare of American mining. With this in mind, we believe that current restrictions on the export of mining machinery to foreign gold mines should be removed, except as such export may interfere with the war effort. These restrictions discriminate against the domestic manufacturer and favor foreign manufacturers of machinery.

MONETARY POLICY

We favor a currency with a metallic base, using gold and silver. We endorse the continued purchase and coinage of domestic gold and silver, as provided by law, and urge the repeal of the prohibitions on free circulation of gold.

SOCIAL SECURITY

We commend the action of Congress in freezing social security payments at present adequate rates.

We recommend the retention and the extension of the merit rating system, in unemployment compensation insurance, under approved laws in the various States.

GOVERNMENT EXPENDITURES

Whatever expenditures are necessary to win the war should be made, but without needless waste and extravagance.

The war should not be made an excuse for unnecessary expenditures. Those not essential to the war should be reduced to the minimum.

We commend congressional action directed toward reduction of expenditures, and urge congressional budgetary control of its aggregate appropriations as a permanent policy.

TAXATION

Taxes, in nature and amount, should be such as will leave to taxpayers an incentive for production of the incomes from which the Government can draw a continuing flow of revenue. Problems of postwar reemployment and industrial readjustments can be solved only if employers and investors can expect that after payments of taxes reasonable net returns will be left to them, adequate to compensate for the capital, ability and effort employed and the risks assumed. For mines particularly, taxes must not impair return of capital and must not be prohibitive against risk capital.

In computing taxable income, full deduction should be allowed for mine development expenditures which are simply advanced costs of mining; depreciation should be so allowable that the full cost of plant and equipment will be recoverable as deductions from taxable income; fair allowance should be made for reserves for deferred development and maintenance and for postwar readjustments and contingencies.

We commend the recognition which Congress has given to fair provisions for taxation of mines. The intent of Congress should not be defeated by unfair, arbitrary Bureau rulings or actions under unpublished instructions.

We further commend the announced intention of Congress to proceed promptly to consideration of administrative and technical provisions of the tax laws. Simplification in procedure and in language is needed to make our tax system practical of administration. Taxpayers who are required to pay the taxes should not be unduly burdened to understand and to comply with our tax laws and their requirements.

* * * *

The Western Division of the American Mining Congress expresses its sincere appreciation for the invitation of the Colorado Mining Association to join with them on this occasion, and for the cordial hospitality extended by the City of Denver and by the mining people of Colorado.

We believe that the policies and programs adopted at this meeting are vital to the welfare of western mining and of the nation, and we urge the full cooperation of every mining man in making them effective.

ing; he touched on the questions of stock-piling, tariff trends, and technical improvements in the industry, and all present conceded him a "home-run" performance.

WPB's order closing gold mines and its result on the gold mining industry were fully discussed by Guy N. Bjorge, general manager, Homestake Mining Co., who pointed out that the shut-down order was both unnecessary and ineffectual, and resulted in the release of not more than 500 or 600 men to non-ferrous mines. Current problems in the procurement of mining equipment were discussed briefly by Arthur S. Knoizen, director of WPB's Mining Division, and the war-time requirements of our military and naval forces were reviewed at length by Brigadier General (now Major General) Clarence H. Daniels, commanding the 7th Service Division, and Captain Frank H. Roberts, commanding officer of all naval units, University of Colorado. The day sessions closed with two motion pictures furnished through the courtesy of the Aluminum Company of America.

Special Roundtable Sessions

Special evening sessions devoted to off-the-record discussions of the problems of the various metals were held on Thursday evening with Howard I. Young, president of the American Mining Congress, presiding over the copper, lead and zinc group; Ira B. Joralemon, consulting engineeer of San Francisco, leading the discussion on the ferro-alloy metals, and Samuel H. Williston, vice president, Horse Heaven Mines, Inc., as chairman of the quicksilver, precious metals and miscellaneous minerals group. Participating in these discussions for the War Production Board were F. H. Hayes, chief, Primary Production Branch, Copper Division; Erwin Vogelsang, chief, Tin-Lead Division; Myron S. Trilsch, Zinc Division; E. Franklin Hatch, assistant director for ferro-alloys, Steel Division; Lewis E. Levensaler, chief, molybdenum, tungsten and vanadium section; Richard J. Lund, chief, Miscellaneous Minerals Division; and Arthur S. Knoizen, director, Mining Division.

The role of heavy metals in our post-war economy was the lead-off subject for the second day, as John D. Sullivan, Battelle Memorial Institute, gave an interesting analysis of the bright prospects for these metals based on our record of pre-war and war-time consumption. "Problems of the Small Mine Operators" were presented by Ray G. Sullivan, manager, Boulder Tungsten Mills, Inc. In discussing the manpower problem of the mines, Brigadier General William C. Rose, chief, executive service, War Manpower Commission, said that the mining situation was one of their worst headaches and he recounted the various steps which have been taken to stop the dangerous downward curve of employment in non-ferrous fields. He discussed the acute problems involved in finding labor to secure needed production from Western mines, both metal and coal, and called on all mine operators for their full cooperation in maintaining personnel. He expressed the opinion that the War Department would not approve release of any additional men for work in the non-ferrous mines and that there would be no cut-backs in manpower requirements for a long time.

At a luncheon meeting of the Board of Governors of the Western Division and the Executive Committee of the Colorado Association, following a brief business session, General Rose held an off-the-record discussion of some of the pertinent phases of the manpower problem. Mine operators took this occasion to acquaint him with certain facts which do not seem to have been fully appreciated by the War Manpower Commission in connection with its attempt to relieve Western mining.

Luncheon meeting, Board of Governors of the Western Division of the American Mining Congress and Executive Committee of the Colorado Mining Association

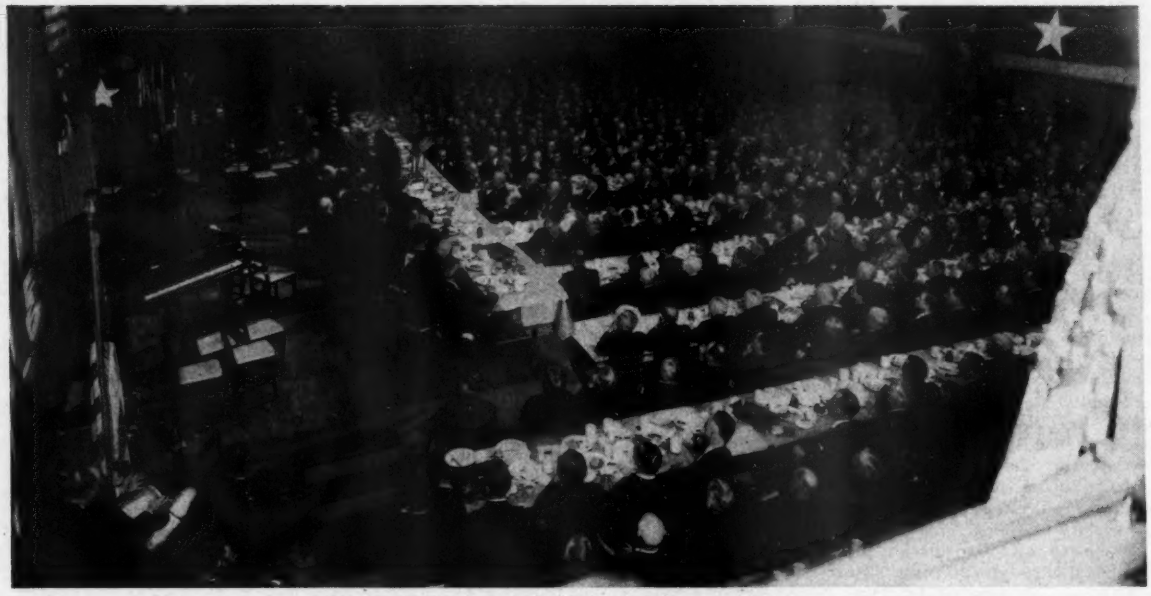
ROBERT M. HARDY, Chairman
Western Division, American Mining Congress

Present Status and Future of the Metals Subject of Symposium

A symposium on the mining industry's problems was held, with leading mining executives presenting brief summaries for the various metals, followed by open discussion from the floor. Scheduled speakers included: J. B. Haffner, general manager, Bunker Hill and Sullivan Mining and Concentrating Company—Lead; Ernest V. Gent, secretary, American Zinc Institute—Zinc; Charles R. Kuzell, Phelps Dodge Corp.—Copper; Carl J. Trauerman, secretary, Mining Association of Montana—Silver; Albert F. Knorp, secretary, California Chapter, American Mining Congress—Gold; Gordon I. Gould, H. W. Gould Company—Quicksilver; D. F. Haley, vice president, Climax Molybdenum Company—Molybdenum; Charles H. Segerstrom, president, Nevada-Massachusetts Company and Elmer Hetzler, Boulder, Colo.—Tungsten; Blair Burwell, general superintendent, U. S. Vanadium Corp., and Robert Sterling, manager, Vanadium Corporation of America—Vanadium; Durand A. Hall, Castro Chrome Associates—Chrome; F. O. Davis, treasurer, Potash Company of America—Potash; and John H. Cole, president, Domestic Manganese and Development Company and Gustavus Sessinghaus, Denver—Manganese.

Mine Taxation

The effects of the current tax program on industry generally, together with a review of the special tax prob-



The "Sowbelly Dinner"—highlight of Colorado's mining year

lems of the mining industry, were presented by Henry B. Fernald, chairman of the Mining Congress' Tax Committee; J. M. Bowlby, president, Eagle-Picher Lead Company; Leo J. Hoban, secretary, Hecla Mining Company; and Samuel H. Williston, vice president, Horse Heaven Mines, Inc. They pointed out that taxes which are too burdensome, in amount or in method of application, threaten corporate expansion as well as current mine production. Particular attention was given to the amendment defining "Gross Income from the Property" for percentage depletion, etc., now finally approved by Congress, and special appreciation was expressed to its sponsor, Senator Edwin C. Johnson of Colorado. A further discussion of tax problems was led by William H. Quinette, Peat, Marwick, Mitchell and Company, and M. D. Harbaugh, vice president, Lake Superior Iron Ore Association.

On Friday afternoon, mining equipment manufacturers held an informal round-table conference with several WPB Mining Division officials, the discussion centering largely around the internal problems of the manufacturers in complying with the multitudinous regulations covering their operations.

Discussing tariffs and international trade at the Saturday morning session, John Lee Coulter, economist and former member of the U. S. Tariff Commission, declared that "prosperity, like charity, must begin at home," and called for sound policies of domestic development. Referring to 1943 as climaxing the "blackest two-year period" the gold mining industry has ever weathered, Merrill E. Shoup, president, Golden Cycle Corporation, predicted that the world would return to the gold standard after the war and that gold mining was destined for a come-back, with a definite possibility of higher prices.

Need of Permanent Stockpile Program Stressed

One of the most interesting discussions of the entire meeting was that dealing with the need of a stockpiling program, led by E. H. Snyder, president, Combined Metals Reduction Company, who substituted for Senator James G. Scrugham of Nevada, detained in Washington by illness. Mr. Snyder asserted that adequate stockpiles of metals and minerals would be our best assurance of the length of the peace to follow this war, because enemy nations would think twice about starting a war if they could see a huge pile of minerals above ground in this country. He suggested that stockpiles include enough metals, minerals and scraps to last two years in case of another emergency, that they be kept entirely out of the hands of bureaucrats, and be circumscribed by controls so tight that it would take an act of Congress to distribute them, and then only in the case of war. Robert M. Searls, well-known mining attorney of San Francisco, followed with the suggestion that the stockpile program would keep in production many mines that otherwise would be forced to close for lack of market, and stated that domestic producers of metals and minerals should be given preference after the war, when foreign purchases are not needed to relieve scarcity in this country or to prevent our enemies from obtaining them.

Stockpiling was pointed out as the means for providing employment by absorbing mine production immediately after the war and until the demand for manufacturers' metal products can overtake the mined output, by F. H. Wardlaw, Jr., manager, International Smelting and Refining Company, in discussing the Prospects for Western Mining. He cited the conditions which will face the industry after the cessation of hostilities and warned that the mines must have at least an even break on metal prices and labor rates if they are to weather the post-war period. Further discussions included Molybdenum Applications, by Telfer E. Norman of the Climax Molybdenum Company, and Exploration for Mineral Reserves, by Dr. G. F. Loughlin of the U. S. Geological Survey.

Annual Dinners Draw Capacity Crowd

The "Silver Dinner" on Friday evening was again an outstanding event and a capacity crowd heard Mortimer Stone deliver an inspiring address following introductions by Toastmaster George E. Stringfellow, vice president, Thomas A. Edison, Inc. Saturday night brought on Colorado's famous "Sowbelly Dinner" presided over by the inimitable John W. Valentine of Boulder, Colo. The Honorable A. B. "Happy" Chandler was the guest speaker and he delighted a packed crowd of mining men with a stirring pro-American speech.

CLEVELAND MDR JUMBO

PROVED BEST BY TEST!

"... we have used these rigs (Cleveland Jumbos) extensively in our drifting programs, and consider them the best piece of equipment we have in use. They will meet your every drilling requirement."

From the General Superintendent of one of America's largest metal mining companies.

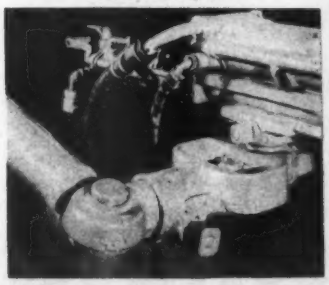
• This report is typical of the praise the Cleveland Jumbo has received from mining engineers everywhere. For the Jumbo reduces drilling time up to 50%, while often increasing rock breakage 25%.

The Jumbo insures *real speed* in setting up and tearing down, and also saves *hard work*. It eliminates straining to lift drifters and columns. You can use larger drills and thus get greater footage. Unusual safety, too—no blocks or wedges to loosen up, no danger due to falling columns or drifters.

The Jumbo permits more accurate spacing of drilled holes, helps maintain the correct angles. Spot holes in the face where you need them, without interference from columns or blocking.

If desired, we will also furnish the car for the Jumbo.
Surprisingly prompt delivery. Write for Bulletin 131A.

A close-up of the elevating mechanism. Note the safety bars.

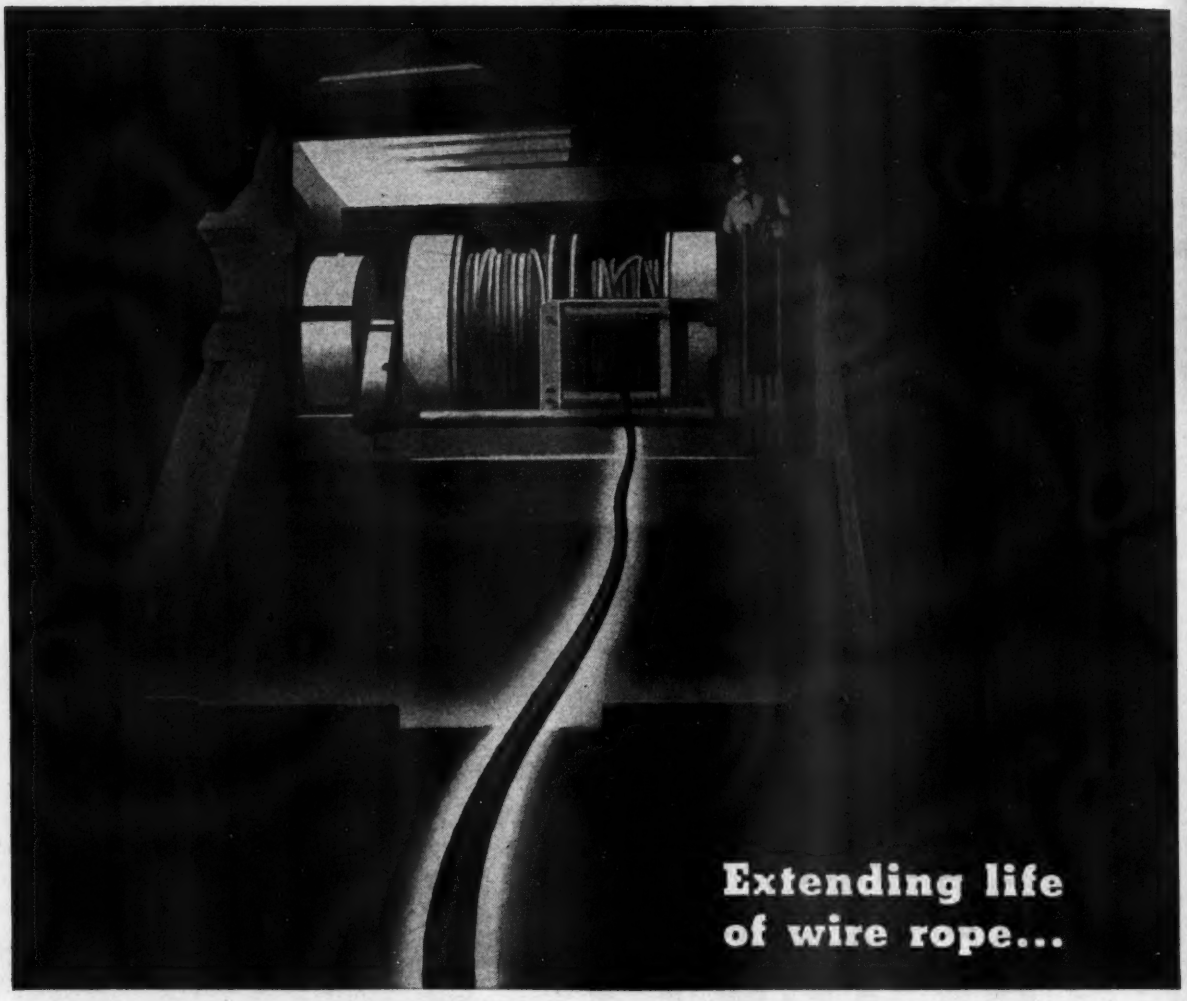


The drifter is set so low in this "banjo" saddle that the lifters can ordinarily be drilled without turning the machine under the bar.

THE CLEVELAND ROCK DRILL CO.

Division of The Cleveland Pneumatic Tool Company • Cleveland 5, Ohio

BRANCH OFFICES IN ALL PRINCIPAL CITIES AND MINING CENTERS



Information supplied by an Industrial Publication

The proper maintenance of wire rope is no longer a matter of debatable economics. It is a matter of sheer necessity. Good wire rope is just as hard to replace as it is vital to mining operations.

The following suggestions are offered in the interest of longer rope service:

1. Use the type and size of rope best fitted for line speed and load conditions.
2. Keep rope in the clear between sheaves.
3. Keep rope thoroughly lubricated.
4. Insure proper spooling on drum, and prevent cross winding.
5. Use sheaves of proper diameter (40-50 times rope diameter).
6. Keep sheave grooves smooth, and sheaves in correct alignment.
7. Prevent rope from twisting, kinking, or jumping sheaves.
8. Avoid overheating, and afford protection from steam, acid fumes, or excessive moisture.
9. Keep rope free from dirt or grit by frequent cleaning.
10. Inspect rope frequently for signs of undue wear or for broken wires.

There is a simple and effective means of making rope safer to handle that also adds to its serviceability. This consists of brazing the rope back for an inch or two with an oxyacetylene torch and bronze welding wire. Sharp wire ends are covered up, and the end of the rope is prevented from unraveling.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

ARMY E NAVY

MOLYBDIC OXIDE, BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company

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MOLY

Wheels of Government

As Viewed by A. W. Dickinson of the American Mining Congress

RETURNING from grass-root contacts with their constituencies, a campaign-minded Congress took the President's $100 billion budget message in its stride but was by no means amenable to his repeated requests for approval of the Treasury's $10½ billion tax program.

The urging of the Administration for a National Service Act likewise met rebuff from individual Senators and Congressmen as well as from the Committees of Military Affairs of both Houses. In sharp contrast, the members of the House quickly and cheerfully joined, 387 to 0, in approving a bill carrying a $300 mustering-out pay for men and women returning from the Armed Services, and following expeditious handling in the Senate the measure was rushed to the White House for a ready signature by the President.

The balance of the time on Capitol Hill has been chiefly given to consideration of the soldier-vote bill, in the handling of which there has been much play of strategy and resulting confusion.

Revenue Bill to President

On January 21, the Senate passed the Revenue Bill of 1943 with few changes from the form reported in our January issue. The Johnson "Gross Income From the Property" amendment was included as was also that raising the credit for exempt excess output for new coal and iron mines from ⅛ to ½ of the net income, and making this provision retroactive to December 31, 1941. Potash and its crystallization process was specifically included in the definition of gross income. Through the effort of Senator McClellan (Dem., Ark.) an amendment was accepted including barite for percentage depletion at 15 percent. Last was the amendment offered by Senator Elmer Thomas (Dem., Okla.) which would have stricken the House clause terminating the percentage depletion allowance for fluorspar, ball and sagger clay, rock asphalt, flake graphite, vermiculite, beryl, feldspar, mica, talc, lepidolite, spodumene (and barite) at the end of the war; the vote on this amendment was close, 38-34.

Shortly before the passage of the bill, Finance Committee Chairman Walter George after expressing his opposition to the Thomas amendment, made some comments which the mining industry will do well to ponder deeply. He said that on the recommendation of the War Production Board a depletion allowance had been granted recently for a number of minerals but that no case had been made out for a permanent depletion rate. Senator George contrasted this action with the original placement in the law of percentage depletion for oil and gas and metals, stating that the original draft was not made in a haphazard manner but was actually done on the basis of a careful investigation and study, as the result of which it was shown that the minerals included were entitled to certain definite percentage rates. These rates, he said, were authorized in place of the discovery allowance previously made in the law which had been found extremely difficult to administer.

Commenting further on the minerals recently included for the percentage depletion allowance, the Senator said "it would be a mistake to put these minerals on a permanent percentage depletion basis at this time without study of the competitive conditions and without demanding that sufficient data be furnished so as to enable the Congress, if it is proper hereafter to fix a permanent deduction for percentage depletion, to say what it should be. We have simply lumped them all together; they are all given 15 percent in computing their taxable income. It certainly will, I must say, upset competitive conditions and widen a gap in the Federal income tax laws as applicable to corporations that will one day, in all probability, lead to the elimination or curtailment of the percentage depletion given to oil and to other materials."

As sent to conference, the provisions on renegotiation of war contracts were changed by the Finance Subcommittee, made up of Senators George, Walsh, LaFollette and Taft, to conform to those of the House bill. The termination date for renegotiation was set at December 31, 1944, with a variation of six months before or after if the President finds that competitive conditions have been restored, or at the termination of hostilities.

As the conferees reported on the bill and the Senate and House gave approval and sent it to the White

Washington Highlights

PRESIDENT—Asks $100 billion for 1945.

NATIONAL SERVICE—Congress cool toward enactment.

REVENUE BILL—On President's desk for approval.

JOHNSON "GROSS INCOME" AMENDMENT—Senate passed and conferees okayed.

TAX RETURNS—Congressmen anxious to simplify.

STATE DEPARTMENT—"Streamlines" for big job.

SURPLUS MATERIALS—A threat to post-war markets.

STOCKPILING—Legislation loses momentum.

PORTAL-TO-PORTAL—Federal Court declares Wage-Hour law does not require pay for travel-time.

House, the House form on the renegotiation amendments largely prevailed but the definition of sub-contractor which would have exempted those who do not produce articles going into the final product purchased by the Government was eliminated and the existing definition of sub-contractor restored. Appeal may be had to the U. S. Tax Court in cases not previously closed by agreement and the Court may consider all cases *de novo*. The Senate-inserted re-pricing provision known as Title VIII survives in the bill but contractors may appeal to the Federal district courts in event of arbitrary price reductions.

Unfortunately, the Senate amendment increasing the credit for exempt excess output of new coal and iron mines was lost but the Johnson "Gross Income from the Property" amendment is in the bill as sent to the White House, with a change made at the earnest request of the Treasury representatives who feared that the cost of smelting and refining processes might be included in the computation of gross income under the terms of the amendment. As changed, one paragraph (iv) of Section 117(c) now reads—"in the case of lead, zinc, copper, gold, silver, or fluorspar ores, potash, and ores which are not customarily sold in the form of the crude mineral product—crushing, grinding, and beneficiation by concentration (gravity, flotation, amalgamation, electrostatic, or magnetic) cyanidation, leaching, crystallization, precipitation (but not including as an ordinary treatment process electrolytic deposition, roasting, thermal or electric smelting, or refining) or by substantially equivalent processes or combination of processes used in the preparation or extraction of the product or products from the ore, including the furnacing of quicksilver ores. The principles of this sub-paragraph shall also be applicable in determining gross income attributable to mining for the purposes of Sections 731 and 735."

The definite statement, in the bill awaiting approval, of this clear-cut definition of gross income by the Senate and House is an example of what can be accomplished by an aroused and unified mining industry, and the sincere thanks of the industry are due to Senator Edwin C. Johnson of Colorado who introduced and fought for the amendment and to Representative Wesley E. Disney of Oklahoma who exercised his rare ability in keeping it in the bill.

Tax Simplification

While still at home during the recess, many Congressmen were faced with protests from their constituents against the complicated nature of the present tax return. Immediately upon returning to Washington, Chairman Doughton of the Ways and Means Committee stated publicly that the first work of his committee would be to grapple with the problem of simplification and that the revenue laws should be so revised that 30 million taxpayers may be freed from filing returns. A bill introduced by Representative Carlson (Rep., Kans.), who worked hard for the pay-as-you-go procedure early in 1943, combines the Victory tax, normal tax and surtax on individuals into a single tax. Carlson's bill eliminates the making of returns where the individual's income is within the first surtax bracket and is hence covered by withholding tax, and under it a short form may be used by taxpayers up to $5,000 of gross income. The matter of simplification of tax collections is a real issue in this campaign year and definite effort on the part of Congress along this line can be expected in the coming months.

Reorganization in State Department

Cordell Hull, Secretary of State, and his new Undersecretary, Edward R. Stettinius, Jr., are reorganizing the State Department in preparation for the far-reaching part it will play in the widely expanded foreign relations of America. Announced is the creation of a policy committee consisting of chief officers of the State Department, and an Advisory Council on Post-War Foreign Policy has been appointed, including Norman H. Davis, chairman of the Red Cross; Myron C. Taylor, special representative for the President on missions to the Vatican; and Dr. Josiah Bowman, President of Johns Hopkins University.

Transportation and communication will be handled by Assistant Secretary Adolph A. Berle, Jr.; economic affairs by Assistant Secretary Dean Acheson; congressional relations by Assistant Secretary Breckenridge Long; and administration and public information by Assistant Secretary G. Howland Shaw.

Termed as "line" offices, the following appointments have been made: John G. Erhardt, Office of Foreign Service Administration; John C. Ross, Office of Departmental Administration; John S. Dickey, Office of Public Information; Wallace S. Murray, Office of Eastern and African Affairs; Stanley K. Hornbeck, Office of Far Eastern Affairs; James C. Dunn, Office of Special Political Affairs, also Office of European Affairs; Laurence Duggan, Office of American Republic Affairs; Harry C. Hawkins, Office of Economic Affairs; Charles P. Taft, Office of War-Time Economic Affairs; with the Office of Transportation and Communications, and the Office of Controls as yet unassigned.

Producers of metals and minerals will watch with interest the work of Harry C. Hawkins in his administration of the Office of Economic Affairs. Previously chief of the Division of Commercial Policy and Agreement, his office was active in the Foreign Trade Agreements program which in post-war times may be of particular significance. It is believed that the stockpiling of minerals as well as of other commodities may come in for the attention of a special staff.

National Service Act

A surprise has come in the past month in the President's advocacy to Congress of a National Service Act, and in the complete reversal by War Manpower Commission Chairman McNutt who has now come out for this type of legislation. The Chief Executive qualified his recommendation to Congress by making it conditional upon the adoption of a "realistic tax law"; continuance of war contracts renegotiation; a "cost of food" law, and reenactment of the Economic Stabilization Act which automatically expires on June 30.

Distinctly cool to National Service Act proposals, which are now supported by the War and Navy Departments, the Maritime Commission and the American Legion, the members of Congress gave little encouragement. The House Committee on Military Affairs has indefinitely postponed consideration of the Austin-Wadsworth bill and the majority of the members of the Senate Committee on Military Affairs have sharply questioned proponent witnesses who have appeared before them in recent weeks. Labor leaders definitely oppose such legislation and the majority of employers are not inclined to give it support.

Disposal of Surplus Materials

Pointed interest in this subject has recently caused the Senate Committee on Expenditures in the Executive Departments to report the bill, H. R. 2795, introduced by Representative O'Leary (Dem., N. Y.) which had been resting in the Committee since its passage by the House last June. In its present form, the bill requires the keeping of current inventory records and detailed procedure for handling surplus property, both real and personal, by the Federal agencies. The measure creates a Surplus War Property Board consisting of the Secretaries of Treasury, War, Navy, and Commerce, and the Director of the Bureau of the Budget. Also included are representatives of labor, agriculture, industry and the general public. Providing for full studies and investigation of surplus property by the Board, this agency is also directed to formulate disposal regulations and to include therein such provisions as may be required to protect the national economy and the interest of the Nation's taxpayers, to prevent resale of Government property by persons or organizations at unreasonable profit, to protect private enterprise from un-

fair competition consequent upon sales of Government property, and to protect and foster development of new industries. The bill is understood to have originated in the Bureau of the Budget and to be designed for peacetime as well as war-time application; in its language it is adapted to operate in connection with related measures such, for example, as a stockpiling law. Although now on the Senate calendar observers believe that further action will be deferred for some time.

Stockpiling

The revised Scrugham Stockpiling Bill, S. 1582, still remains in the Senate Mines and Mining Subcommittee. Senator Scrugham has been away from the Capitol for some time and such further action on this measure as may ensue awaits his return. Meanwhile, Representative Richard S. Harless (Dem., Ariz.) has introduced H. R. 3991 which would restrict the disposal of strategic or critical minerals or metals in the possession of Federal agencies except for governmental use. The bill authorizes transfers of such materials to the Metals Reserve Company but otherwise disposal can only be made by an act of Congress. The Metals Reserve Company is directed by the measure to purchase the production of strategic or critical metals from each small or marginal mine whose owner or operator shows unrecovered investment intended and reasonably likely to augment needed war-time production, at prices established for such mine during the war or reasonably anticipated as the basis of making the investment and necessary to its recovery, until such investment is recovered, but only during the war and three years thereafter. By the terms of the bill, the Metals Reserve Company would be continued as a corporation with powers sufficient to administer the requirements of the bill for such period of time as may be necessary.

Underground Travel Time

While the bituminous mines under Government control are operating in line with the terms of the Ickes-Lewis wage agreement, no word has come from the War Labor Board concerning the approval or disapproval of the agreement signed by bituminous coal operators and miners on December 17. Meanwhile, the railroads have been turned back to the owners as of January 18 on the basis of a 9 to 11 cent-per-hour wage increase, and the steel workers' demand for an even greater amount is now the subject of a public hearing before the WLB in Washington.

A preliminary report has been rendered by the President's committee studying underground travel time which shows a weighted average of 55.29 minutes daily underground travel time, in returns received from 1,000 mines producing about 63 percent of underground bituminous coal production. Employes to the number of 141,000 are covered in the study, and the travel time for individuals was found to vary from 5 minutes to 3 hours and 3 minutes. The chairman of the committee reported to the President that final determinations on travel time will probably be somewhat higher. WLB Chairman William H. Davis is reported to have said that until his Board examines the exhibits it cannot tell whether present data will be sufficient or whether it will be necessary to wait until the full report is available.

As yet the Supreme Court has not rendered its decision in the iron ore mines portal-to-portal case sent up from Birmingham, Ala., but on January 26 Judge A. P. Barksdale in a Virginia Federal District Court handed down a decision in the case of the Jewell Ridge Coal Corporation, ruling that travel time shall not be considered as time worked under the Fair Labor Standards Act. The Court's ruling stated that:

"(1) That the Fair Labor Standards Act of 1938 does not require that there be included within the workweek of underground workers in plaintiff's mines, either time spent by such employes outside the portal of the mines before entering therein, or time spent in traveling from the portals to their places of work and return; and

"(2) That plaintiff, in computing the workweek of its underground employes on the basis of hours of work in the mines at their usual working places, exclusive of the lunch period, and the time spent outside the portals, and travel time from the portals to their usual working places and return, as provided in the effective wage agreements and continuations thereof, and in paying its underground workers for their services on that basis, has complied with and discharged all its obligations imposed upon it by the Fair Labor Standards Act of 1938."

Judge Barksdale laid heavy stress on the letter of July 9, 1940, addressed by Earl Houck of the U. M. W. A. and a group of coal operators to the Administrator of the Wage and Hour Division of the Department of Labor.

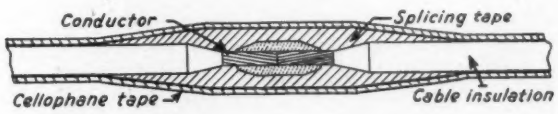
Promptly the Southern Appalachian Operators Association's President Edward R. Burke announced that he will request the War Labor Board to withdraw its approval of the Ickes-Lewis Coal Wage Agreement.

Splicing Mining Cables

(*Continued from page* 107)

*** SPLICING THERMOPLASTIC INSULATED CABLE**

Heated-mold Method



The preferred procedure in splicing thermoplastic insulated cable is to use heated molds in pressure vulcanizers. This method results in a splice having the greatest oil and moisture resistance.

1. Splice the copper conductors together in the conventional manner used for rubber-covered cable.

2. Pencil down the insulation for a relatively long distance.

3. Roughen the taper and the insulation adjacent to the taper with a rasp.

4. Apply thermoplastic splicing tape with a ¼ lap.

5. Build up with tape to a wall thickness slightly greater than the insulation thickness, and carry the tape to a point about 1 in. beyond the shoulder of the tape on either side of the splice. Make the diameter over the tape as uniform and as close to the diameter of the mold as possible.

6. If necessary, seal the end of the tape with a moderately warm iron to prevent unraveling.

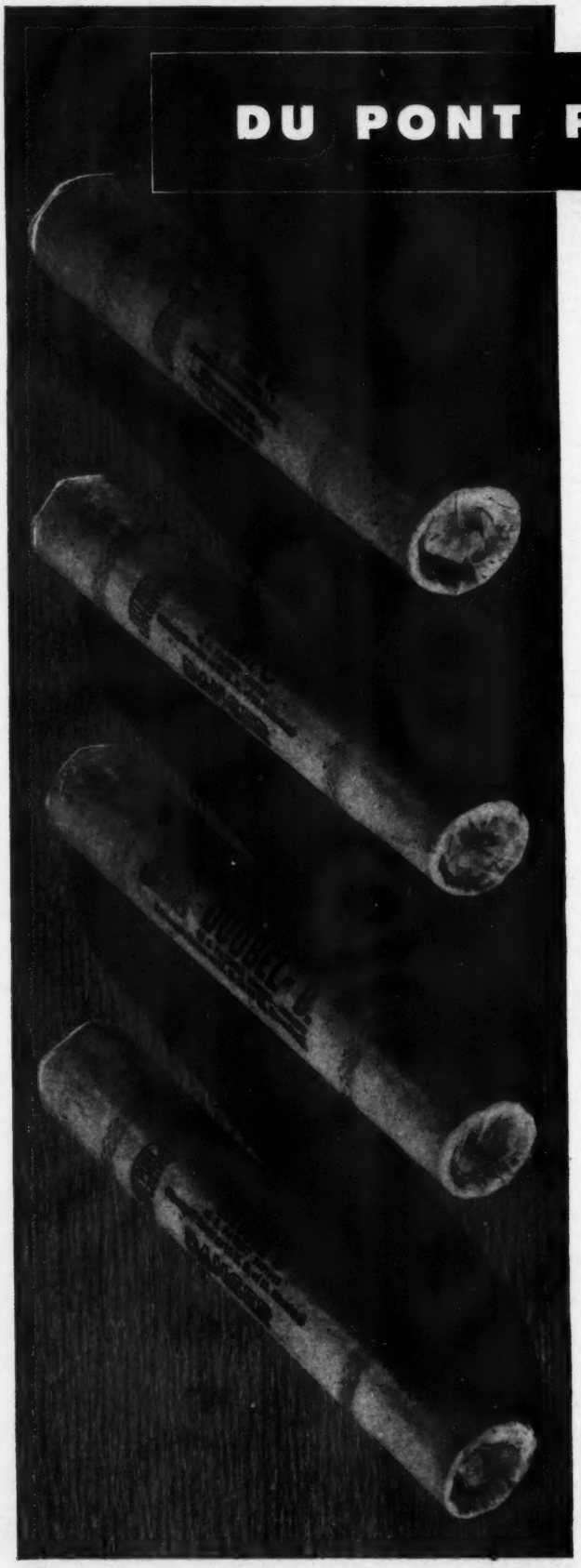
7. Apply a layer of cellophane tape as tightly as possible with a lap, and extend this tape at least 2 in. beyond the ends of the mold.

8. Place the splice in a heated mold. The temperature of the mold should be between 300 and 310 F. The time of heating should be just sufficient to flux together the wrapped layers of tape.

9. Remove the splice from the mold. The cellophane tape should never be loosened or removed from the splice until the splice is thoroughly cooled. The cellophane may be left on over the splice.

* Submitted by R. S. Sage.

DU PONT PERMISSIBLES



WHATEVER the problem, you'll find a Du Pont permissible in a type and grade especially adapted to meet its requirements. Prove this by checking the list below:

"LUMP COAL" C—an exceptionally low velocity permissible with a wide spreading range. Produces big lump that's easier to load. "Lump Coal" C saves time, labor and materials because fewer drill holes are required. It's the most widely used permissible.

"MONOBEL" SERIES—a series of medium velocity permissibles with slow, heaving actions that bring down a high percentage of coarse coal. "Monobel" C is the most popular of these permissibles.

"DUOBEL" SERIES—these strong, high velocity permissibles give you maximum tonnage per pound of explosives used. Grades A, B and C can be used in moderately wet work.

"GELOBEL" SERIES—for rock work, or coal where water conditions are bad. These are high velocity permissibles but produce a good grade of coal. "Gelobel" C due to its high stick count is most economical to use.

COMPLETE LINE OF DU PONT PERMISSIBLES

Grade	Cartridges per 50 lb 1¼"x 8" (a)	Velocity feet per second (b)	Fume Class (c)	Cartridges per 1½ lb 1¼"x 8" (d)
"Duobel" A.....	135	9,200	A	4.1
"Duobel" B.....	150	9,000	A	4.5
"Duobel" C.....	165	8,800	A	5.0
"Duobel" D.....	185	8,400	A	5.6
"Duobel" E.....	205	8,000	A	6.2
"Duobel" F.....	225	7,400	B	6.8
"Duobel" G.....	250	7,100	B	7.5
"Monobel" A.....	135	7,000	A	4.1
"Monobel" B.....	150	6,400	A	4.5
"Monobel" C.....	165	6,200	A	5.0
"Monobel" D	185	6,100	B	5.6
"Monobel" E.....	205	6,000	B	6.2
"Lump Coal" C...	118 (e)	5,000	A	3.5 (e)
"Lump Coal" CC.	165	5,500	A	5.0
"Gelobel" A.....	96	14,000	A	2.9
"Gelobel" B.....	108	11,500	A	3.2
"Gelobel" C.....	120	11,500	A	3.6

(a) 3% allowable variation. (b) unconfined. (c) Bureau of Mines data. (d) charge limit. (e) not made in less than 1½" diameter 118 cartridges 1½"x 8"; 115 cartridges 1¾"x 6"

Whenever you have an explosives problem, feel free to consult a Du Pont representative, or write E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, Wilmington, Del.

DU PONT

REG. U.S. PAT. OFF.

PERSONALS

Robert L. Dean, formerly general superintendent of the Combined Metals Reduction Company mine at Pioche, Nev., has been made executive assistant to **E. H. Snyder,** general manager, with headquarters in Salt Lake City. **L. G. Thomas** was appointed general superintendent at Pioche, and **Sam Arentz,** mining engineer and geologist, has been promoted to mine superintendent.

R. S. Baylor, for the past 20 years general superintendent of the Berwind-White Coal Mining Company, retired February 1. He was succeeded by **John M. Kerr,** who has been assistant superintendent of mines for the past 10 years.

Mr. Baylor has been employed by the Berwind-White Company for 43 years, being a foreman for 23 years prior to his appointment as general superintendent.

Philip A. Lawrence has been appointed purchasing agent of Nicaro Nickel Company and Cuban-American Manganese Corporation, subsidiaries of Freeport Sulphur Company, accord-

Philip A. Lawrence

ing to an announcement by **Langbourne M. Williams, Jr.,** president of Freeport Sulphur Company. Mr. Lawrence, a graduate of the University of Indiana, has been with Freeport Sulphur Company since 1940.

Wm. H. Cooke, formerly vice president of Walter Bledsoe and Co., announced on February 1 the organization of Associated Coals, Inc., a general coal selling agency. Mr. Cooke heads the new organization as president, with headquarters in Chicago. **Joe W. Gorenz** was appointed resident manager in Peoria, Ill.

Jones & Laughlin Steel Corporation announced on January 3 the appointment of **Grover E. Leveque** as vice president of two of its subsidiaries, the Inter-State Iron Company and Jones & Laughlin Ore Company. Mr. Leveque's headquarters will be in Pittsburgh.

Robert McL. Johnson, formerly chief engineer, succeeds Mr. Leveque as general superintendent of the two companies with headquarters at Virginia, Minn.

D. D. Moffat, president and general manager of Utah Copper Co., was elected president of the Utah Metal Mine Operators Association at its annual election in December. **A. G. Mackenzie** was reelected manager. Mr. Moffat succeeded **F. S. Mulock,** vice president and general manager of Western operations, United States Smelting, Refining & Mining Co. Other officers elected were: **Frank A. Wardlaw, Jr.,** first vice president; **E. H. Snyder,** second vice president; **James W. Wade,** third vice president.

Louis Ware, president of International Minerals & Chemical Corporation of Chicago, was elected on January 11 to the Board of Directors of the First National Bank of Chicago. Mr. Ware has been president and director of International since August, 1939. He has had long executive experience in the mining, engineering and banking fields. For several years, he was an executive of the New York Trust Company.

Dr. Charles A. Getz, director of the Research Division of Cardox Corporation, has been elected to fill the newly created position of vice president in charge of research of that company, according to an announcement issued by **Allyn Harris,** president.

John C. Cosgrove, consulting engineer of Johnstown, Pa., has been elected to membership in The Newcomen Society of England, a British Honorary Society which centers its interest in the history of Material Civilization: the beginning and growth of those factors which have contributed to man's progress in Industry, Transportation, Mining, Finance, the Law, and Education.

— *Obituaries* —

Dr. George Otis Smith, noted geologist, who was director of the U. S. Geological Survey 23 years and former chairman of the Federal Power Commission under President Hoover, died January 10, at Skowhegan, Me., following a heart attack. He was 72 years old.

Dr. Smith was interested in the development of oil, power and water resources, and was instrumental in the enactment of Federal oil, land and

mineral leasing laws. During his nearly 40-year Federal service record, he also was a member of the U. S. Coal Commission. He joined the Geological Survey in 1896 and was made director in 1907, serving in that capacity until 1930, except for a period in 1922-1923 when he was on the Coal Commission.

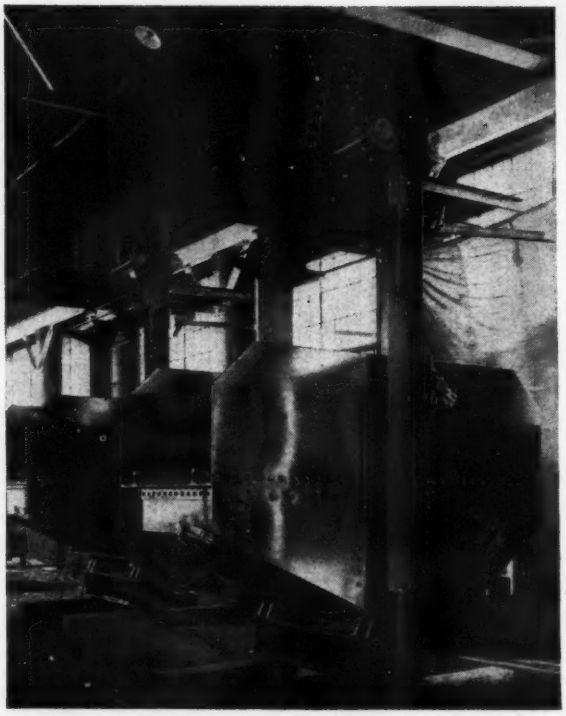
He was the author of various reports in publications of the Geological Survey and editor and co-author of "Strategy of Minerals," published in 1919.

Ira S. Ramsey, superintendent of mines of the Fleming Division of the Elk Horn Coal Corporation, died suddenly on December 20, 1943, in Fleming, Ky. He was 59 years old. Mr. Ramsey was well known in mining communities in Alabama, Kentucky, Pennsylvania and West Virginia. He was a member of the National Mine Rescue Association and assisted in the recovery work following a large number of explosions.

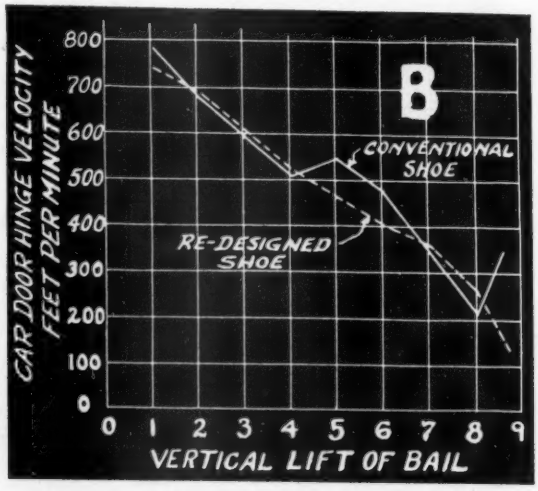
Clark MacQuown, assistant editor and business manager of MAC'S Directory, died in Pittsburgh on Sunday, January 16. He had been associated with the Directory since its inception in 1920 and a great deal of its development work was due to his efforts.

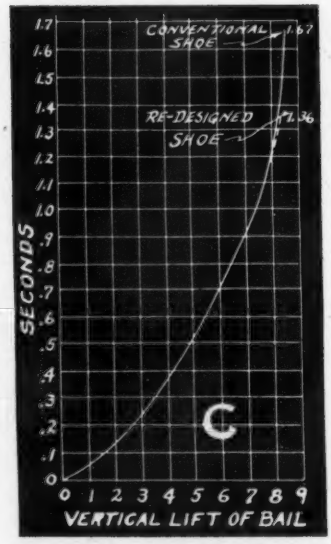
T. J. O'Brien, president of the Kemmerer Coal Co., died on Wednesday, February 9, at a hospital in Salt Lake City, Utah. Mr. O'Brien was vice president of the Gunn-Quealy Coal Co., and has been actively identified with the operations of both companies for many years. He was also president of the Southern Wyoming Coal Operators' Association.

MORE HOISTS PER HOUR *with* HOLMES CAGES *and* DUMP SHOES



In designing Holmes all-steel cages all excess weight has been eliminated and accurate consideration is given to the proper distribution of the load, so that side sheets are relieved of excessive strains and the weight is transmitted directly to the lower bail members. They are fabricated to close tolerance for smooth, rapid operation.





Each cage design must be taken individually and its dumping cycle calculated for a shoe to give uniform deceleration. On Chart B we have plotted the dumping cycle for a large hoist making an average of more than four dumps per minute. For convenience, a point located at the car door hinge was selected and timed from the point of contact of dump roller with the shoe until the cage platform had been inclined to 45 degrees. A solid line traces the path of this point in feet per minute operating on a conventional type of shoe and indicates most irregular deceleration with a velocity of 320 feet per minute at full dump. In spite of a spring cushioned hook, caved-in doors and mishooks were not uncommon in the operation.

Smoothing out the cycle by redesigning the shoe to fit cage and speeds, the velocity dropped uniformly to 140 feet per minute, as indicated by the dotted line. After this change was made a rope life increase of 30% was noted, as well as reduced maintenance on cage and cars.

With the conventional shoe, spillage of coal is often a serious problem, being brought about by too abrupt a change in direction of movement and lack of uniformity in the movement.

In Chart C the vertical lift of the bail is plotted against time in seconds; and it will be noted that while smoothing out the cycle time was reduced 0.31 seconds, which adds about 4 hoists per hour.

Holmes dump shoes are tailor made of structural steel for each individual installation.

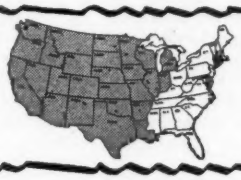
ROBERT HOLMES & BROS., Inc.

DANVILLE, ILLINOIS

Designers and Fabricators of Mining Equipment for Over 70 Years

News and Views

Eastern States



PENNSYLVANIA

»»» Two of Greene county's largest coal companies mined 330 acres of bituminous coal in 1943, according to tax reports filed at the county commissioners' office in Waynesburg.

The Mather Collieries Co. at Nemacolin mined 229.1867 acres, of which 133.79 was in Cumberland township, where the mine is located, and 95.418 in adjoining Monongahela township.

The Mather Collieries Co. at Mather mined 100.2480 acres, of which 73.98 was in Morgan township, where the mine is situated, and 26.258 in adjoining Jefferson township.

»»» Assisting beehive coke-oven operators to improve the quality and uniformity of coke needed to increase the production of iron and steel, the Bureau of Mines has published a preliminary report (R. I. 3738) outlining operating practices of a western Pennsylvania plant recognized for producing coke of good quality, Dr. R. R. Sayers, Director of the Bureau, announced recently.

Beehive coke, largely supplanted by by-product coke, has not been made on a large scale for approximately two decades. Few of the skilled operators of the era now are available, and production "know how" is limited.

The quality of coal supplied to the ovens has declined in many instances. Consequently, when it became necessary to supplement available by-product coke with beehive coke to meet the wartime needs of the blast furnaces, some of the substitute fuel, lacking in quality and uniformity, reduced the iron output.

This initial report contains information on coke-oven temperatures, exit gases, and coal quality, together with procedures used in their determination. Most of the tests were made in two ovens, an old poorly insulated one and another well maintained and well insulated. Further studies are necessary and are being made, but the

S. A. Trengove Appointed Editor of Mining Congress Journal

STANLEY A. TRENGOVE has resigned as head of the Department of Mining, School of Mines and Metallurgy, Rolla, Mo., to become Editor of The Mining Congress Journal, effective March 1.

Coming from an old Cornish mining family, and a graduate of the University of Minnesota, Mr. Trengove has a broad background of mining experience. Prior to his last three years as Professor of Mining at Rolla, he was Production Engineer and later Assistant District Superintendent for the Oliver Iron Mining Company, with responsibility for operations in the world's largest iron ore mine, the Hull-Rust, at Hibbing, Minn. He had previously done extensive work in connection with mine valuations, operation of underground and open pit mines, ore dressing and metallurgical problems for various mining and manufacturing companies, and in recent years has made special studies of coal, zinc and lead, bauxite and other properties in the central and southwestern states. He was for several years on the faculty of the Minnesota School of Mines and Metallurgy, and is the author of various papers on mining practice and advances in mining technology, drilling and blasting, mechanical loading and haulage, ventilation, mine safety and other subjects.

Mr. Trengove's wide experience and contact with the problems of mining operations and mineral economics particularly fit him for the work of serving the industry through the columns of its Journal.

information already acquired and incorporated in this report will be of value to operators whose ovens are not operating smoothly and not producing good coke.

»»» Governmental approval was obtained by the Pennsylvania Coal Company, Scranton, to increase by five percent the wages of around 170 clerical and non-union employes. If the increase becomes applicable to all the non-union workers in the anthracite industry, some 10,000 employes will be benefited.

»»» The recent order of the Solid Fuels Administration, barring shipments of anthracite to mid-west areas, invalidated years of promotional work to regain a market lost during the last war. Orders of this type have been publicly deplored by Major W. W. Inglis, president of the Glen Alden Coal Company, the world's largest producer of hard coal. He expressed the opinion that the shortage of fuel was not sufficiently acute to warrant so drastic an order, and feared its effect upon post-war efforts to maintain a market for anthracite.

»»» According to the office of Recorder of Deeds, Schuylkill County, approximately 3,000 acres of anthracite coal lands have been sold since the beginning of the year. Northumberland County also reports the sale of several large coal tracts.

WEST VIRGINIA

»»» Coal Mines Administrator Harold L. Ickes has commended the employes and officials of the West Virginia Coal and Coke Company of Cincinnati, Ohio, for outstanding production by the company's mines of coal to win the war. The company's eight mines are located in Norton and Omar, W. Va.

C. J. Potter, Deputy Coal Mines Administrator, made public the following congratulatory telegram he had sent to Charles Dorrance, Operating Manager for the United States of the West Virginia Coal and Coke Company:

"In view of the Nation's critical need for fuels to win the war, I wish to congratulate the employes and officials of the West Virginia Coal and Coke Company of Cincinnati, Ohio, on their production of 3,608,558 tons of coal in 1943, over the record 1942 output of 3,404,300 tons of coal. Considering the handicaps under which you were working in 1943, the year's output of 5.93 tons per man per day, compared to the 1942 figure of 5.18 tons per man per day, an increase of 14½ percent, is a splendid illustration of your determination to do your part in producing the coal to win this war. I hope that you will display this telegram where every member of your organization may see and realize that his efforts are recognized and appreciated."

»»» Two new coal companies have been incorporated in West Virginia. The Powellton Coal Company, which will have its chief operations in Logan County, includes James D. Francis, president of the Island Creek Coal Company; R. E. Salvati, president of the Pond Creek Pocahontas Coal Company, and G. J. Stollings, vice president in charge of operations and general manager of Mallory Coal Company, among its incorporators. The Kanawha Coal Corporation of Beckley, which will operate in Kanawha County, was incorporated by Ellsworth H. Shriver, assistant general manager of Raleigh Coal & Coke Company, A. K. Canterbury of the Johnson-March Corporation, and A. F. Castanoli of Huntington, W. Va.

Mine Inspectors' Institute Plan Meeting in June

Mine inspectors, mine executives and safety men, members of the Mine Inspectors' Institute of America, will assemble at the Daniel Boone Hotel, Charleston, W. Va., on Monday and Tuesday, June 5 and 6, to find some way of "backing the attack" on the Axis by reducing the accident toll at coal mines. Jesse Redyard, chief, Department of Mines, Charleston, W. Va., heads the local West Virginia committee that will welcome the visitors and their wives. C. A. McDowell is secretary, 427 Park St., California, Pa.

NEW YORK

»»» The American Institute of Mining and Metallurgical Engineers will hold its 160th meeting in New York City, February 20-24. General headquarters and place of all technical sessions, will be the Waldorf Astoria Hotel.

KENTUCKY

»»» Construction work on two railroad extensions, tapping new coal mine areas in eastern Kentucky and costing about $7,000,000, are expected to be completed early in 1945.

The Chesapeake and Ohio Railroad is extending a line from Millard, Ky., in Pike County, along the Levisa Fork to a point near Grundy, Va.

I. L. Pyle, Richmond, Va., chief engineer of the company, estimates that the 28-mile extension will involve expenditure for equipment around $5,000,000.

The Louisville and Nashville's Leatherwood creek branch will tap a virgin coal field which is being opened by Blue Diamond Coal Co. on land owned by the Kentucky River Coal Corporation.

NORTH CAROLINA

»»» A report on the magnetic iron ores of western North Carolina and eastern Tennessee prepared by the Geological Survey, U. S. Department of the Interior, has been placed in open files in the office of the State Geologist, Dr. J. L. Stuckey, Division of Mineral Resources, Raleigh, N. C., as well as in the Survey offices in Washington.

»»» Search for new sources of mica, one of North Carolina's most important contributions to the war, is now in progress in the state. Dr. White, assistant state geologist, plans investigations in Franklin and other counties where there is a likelihood of finding mica

Mica has been projected into the spotlight of national attention by publicity about the Colonial Mica Corporation, subsidiary of Metals Reserve, and which is the only buying agent for mica today. Output of all mines in North Carolina, as well as in other states, is bought by Colonial. These mines in North Carolina today number more than 250, and are confined to western counties.

He is interested only in clear sheets, as transparency is one of the essentials of the product needed by the industry which is producing radios, radar, generators, and many other things without which the war could not be continued.

The quickened activity in North Carolina's minerals is based on a firmer foundation of information since the survey of mineral resources by the H. A. Brassert firm of mining consultants, New York. The Federal program of charting the nation's resources was geared up to North Carolina's survey and the Federal magnetic survey and drilling program will be a definite guide for future mining development in the state, Dr. Jasper L. Stuckey, state geologist, pointed out.

1944 Coal Mine War Conference

ON MAY 1 and 2, the coal industry will meet at the Netherland Plaza Hotel, Cincinnati, Ohio, for the 1944 Coal Mine War Conference sponsored by the American Mining Congress. Charles Dorrance, President, West Virginia Coal & Coke Corporation, has accepted the National Chairmanship of the Program Committee; state and district committees, headed by the following chairmen, will hold meetings this month in the various coal fields, to complete plans and to select subjects for discussion at this important conference:

CHARLES DORRANCE

PENNSYLVANIA—Charles B. Baton, Consulting Engineer, Pittsburgh.

ANTHRACITE—Evan Evans, Jr., Vice President, Lehigh Coal and Navigation Co.

OHIO—L. J. Lorms, General Manager, Lorain Coal and Dock Co.

INDIANA—P. L. Donie, Vice President, Mariah Hill Super Block Coal Co.

ILLINOIS—F. S. Pfahler, President, Superior Coal Co.

WEST VIRGINIA—W. L. Doolittle, Vice President, Consolidation Coal Co.

KENTUCKY—J. F. Bryson, Safety Director, Harlan Coal Association.

VIRGINIA—H. W. Meador, Vice President, Stonega Coke and Coal Co.

ALABAMA—C. E. Butt, Alabama Power Co.

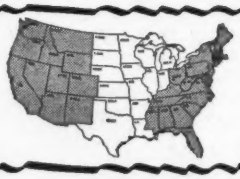
ROCKY MOUNTAIN—Alex Grant, General Superintendent, Rocky Mountain Fuel Co.

STRIP MINING—Hugh B. Lee, Vice President, Maumee Collieries Co.

Metal Mining in the Eastern States, 1943

Production of gold, silver, copper, lead, and zinc reported by mine operators in the Eastern states from January through October or November, and an estimate for the rest of the year, show a total output for 1943 (in terms of recoverable metals) of 2,769 fine ounces of gold, 113,476 fine ounces of silver, 14,202 short tons of copper, 4,600 short tons of lead, and 198,500 short tons of zinc, according to the Joplin Office of the Bureau of Mines. These figures indicate no variation from 1942 in copper production and only 125 tons (3 percent increase) in lead, 1,309 tons (0.66 percent decrease) in zinc, and 8,169 ounces (8 percent increase) in silver. Gold production, however, decreased heavily owing to war-time closing in the latter part of 1942 of most of the gold mines in the Southern Appalachian region; the output—nearly all derived from base-metal ores—decreased 11,930 ounces (81 percent) from 1942.

Central States



MISSOURI

»»» Park City Consolidated Mines Co., a Utah corporation, which entered the Tri-State district last year, has placed its Missouri mine on a producing basis. A 500-ton-per-day milling plant has been completed and is operating on a basis of 300 tons per day. Production is expected to be stepped up gradually to 500 tons per day. Seven thousand tons of ore have been stockpiled ready for milling, and ore developments in the mine are said to be gratifying.

»»» The Ozark Ore Company, a subsidiary of the M. A. Hanna Co., has been authorized by National Defense Plant Corporation to rehabilitate the mine and mill plant buildings of the Iron Mountain mine in Missouri, it has been announced by Earl E. Hunner, General Manager of the M. A. Hanna Company. The mine, developed for both open pit and underground operations, has been idle 13 years and one of the first steps taken will be the unwatering of the open pit area. Resumption of operations will make available an estimated 3,500,000 tons of good grade direct shipping ores and concentrates, which will be shipped as mined to the Koppers United Furnace at Granite City, Ill. W. E. Dewald, formerly superintendent of Hanna's Hiawatha iron mines at Iron River, Mich., has been appointed superintendent of operations at Iron Mountain.

SOUTH DAKOTA

»»» Mines in South Dakota yielded in 1943 (in terms of recoverable metals) 113,352 fine ounces of gold, 41,700 fine ounces of silver, 52,000 pounds of lead, and 48,000 pounds of zinc, according to the Denver Office of the Bureau of Mines, United States Department of the Interior. These figures are based on 10 months' actual mine production with November and December production calculated from reports by mine operators and smelters of anticipated shipments and receipts.

Gold mining was virtually nonexistent in South Dakota by the end of 1943. Operations at all of the major gold mines but two were suspended by December, 1942, either as a result of the Gold Mining Limitation Order issued by the War Production Board on October 8, 1942, or by the inability of these mines to compete with the war industries for labor, materials, and equipment.

The Belle Eldridge Gold Mines, Inc., continued to operate its group of claims in the Whitewood district, Lawrence County, and made several shipments of lead concentrates to the smelter at Leadville, Colo., and zinc concentrates to Amarillo, Tex. The zinc-lead ore is mined from the Helen Gould claim in Spruce Gulch, two miles south and east of Deadwood, and is milled in the company's 75-ton selective flotation mill at Deadwood.

ILLINOIS

»»» The election of E. F. Stevens as a vice president of Binkley Coal Co., and of Pyramid Coal Co., effective February 15, has been announced by R. E. Snoberger, executive vice president. Mr. Stevens, formerly in charge of the Union Colliery Co.'s mines in Illinois, will have direct charge of all the operations of the two companies in Illinois and Missouri, and his office will be located in the Railway Exchange Building in St. Louis. B. H. Schull, who in the past has carried the burden of management of Binkley and Pyramid properties in Indiana, Illinois and Missouri will now give his entire attention to the mines located in Indiana. Mr. Stevens' addition to the operative management personnel was made necessary by recent and future expansion of the production program of these companies.

OKLAHOMA

»»» The Eagle-Picher Mining & Smelting Co. has announced the abandonment of its operations at the Navy Bean mill and the Decker, Owen and Stephens mines in the Wentworth area, Oklahoma. Pumps have been pulled and a final clean-up made at the mill. G. C. Niday, Miami, Okla., is manager of the company's Tri-State mining operations.

Railroads Make Another Record in Moving Coal in 1943

More than 10,500,000 cars of coal were transported by the Nation's railroads during 1943, the Office of Defense Transportation reported in January. Total loadings of bituminous and anthracite for the year totaled 10,601,835 cars, an increase of eight-tenths of 1 percent above the 1942 total of 10,418,079 cars. Officials pointed out that had it not been for

several interruptions to mining during the year, the railroads would have been able to handle a considerably larger tonnage of coal.

Reports to the coal section of the ODT's Division of Railway Transport show that total bituminous loadings were up 2.5 percent from 9,377,862 cars in 1942 to 9,611,201 cars in 1943. Total anthracite loadings dropped 4.8 percent from 1,047,217 in 1942 to 990,634 in 1943.

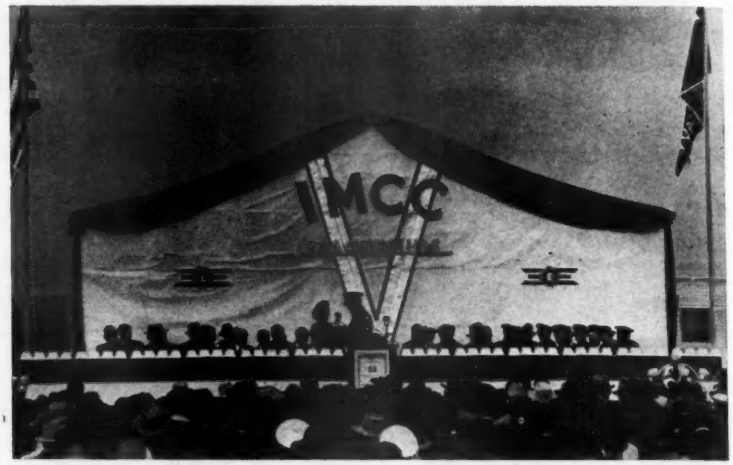
Loadings of bituminous coal in the Eastern and Southern districts totaled 7,771,197 cars in 1943, against 7,720,-833 cars in 1942, an increase of seven-tenths of 1 percent.

ODT coal officials explained that the Eastern and Southern districts are those designed by the Association of American Railroads and include all coal loaded by railroads east of the Mississippi River and on the Wabash Railroad in Iowa and Missouri, but does not include approximately 60 percent of the Illinois-Indiana loadings and the loading on the St. Louis-San Francisco Railway in Alabama.

The Western district, which includes all other coal in the United States, loaded a total of 1,840,004 cars in 1943, as compared with 1,657,029 cars in 1942, an increase of 11 percent.

An analysis of the Western district's loadings shows that this area shipped 19.1 percent of the country's bituminous coal in 1943, as compared with 17.7 percent in the previous year.

Army-Navy "E" to Austin Plant of International Minerals & Chemical Corp.



EMPLOYES of the Austin, Tex., Magnesium Plant of International Minerals & Chemical Corporation of Chicago, were awarded the Army-Navy "E" Award, on November 30, for high achievement in the production of war materials. Previously, in August, the "E" Award was made to International's employes at its Potash mine and refinery in Carlsbad, N. Mex.

"It has been a privilege to develop this project for the Government," declared Louis Ware, president, in speaking of the Magnesium Plant "E" Award. "We are pleased that the prompt and successful production of magnesium at the Austin Plant has provided important quantities of this metal for use by the War Industries."

Lieut. Col. Arthur W. Crossley, Office of the Chief, Chemical Warfare Service, Washington, D. C., made the presentation of the "E" Award. Lieut. Commander R. W. Hippen, Inspector Naval Material, Houston, Tex., presented the "E" pins to employes.

Western States

Message from Donald Nelson to Western Mining Men

THE following telegram from WPB Chairman Donald M. Nelson was received by Howard I. Young, president of the American Mining Congress, at the Western Mining War Conference in Denver on January 28:

"I want to take this opportunity to tell those attending the joint meeting of the American Mining Congress and Colorado Mining Association in Denver that the War Production Board is deeply appreciative of the remarkable record made by the American mining industry during the past year. Our great production goals could not have been reached without your spectacular achievement in mineral production.

"While taking satisfaction in what has already been done, we must at the same time recognize that our production efforts, from both small and large mines, will have to be strongly sustained in the months to come. We have a tremendous task today simply to maintain necessary existing rates of output. War is unpredictable, and it is impossible to say what surprising turns it may take in the future, but the present fact is that our requirements for minerals in general are not decreasing, although in some few cases your fine production achievements have enabled us to reduce output.

"Recognizing the place of the domestic mining industry in the critical period that lies ahead for the country, a month ago, by administrative order, we created within the War Production Board the post of Vice Chairman for Metals and Minerals. All problems relating to mineral and metal production, including quota premiums and the quota committee, have thus been brought together under a single head.

"The policies of the War Production Board in relation to the mining industry will, as before, be aimed at maintaining mineral production at safe levels, in line with the all-out character of the war effort. In settling these policies and particularly in dealing with the difficult questions affecting premiums and imports, you may be assured that the War Production Board will not for one instant lose sight of the very real problems confronting domestic mines, and whenever the day comes for substantial curtailments or for full reconversion to a peace economy, it is our firm purpose to make certain that the domestic mining industry and each individual enterprise within that industry is treated fairly and equitably, insofar as we are able and authorized to do so.

"I feel that I can ask you, in a spirit of mutual understanding and cooperation, to prosecute your share in the nation's fight with unremitting zeal and energy.

DONALD M. NELSON,
Chairman,
War Production Board."

Fluorspar

(*Continued from page* 103)

cides, and new chemical compounds is expected to require increasing quantities this year and in succeeding years. Chemicals containing fluorine are now important industrial reagents and it is known that a number of the chemical companies are actively conducting research work to develop new uses and products. It is not yet possible to make tonnage forecasts reflecting these developments.

Since the expected 1944 requirements of acid grade fluorspar should considerably exceed the current rate of production, some expansion of existing facilities has already been authorized by War Production Board. It is unlikely, however, that it will be found necessary to construct any additional new facilities using Government funds, but small additions to existing facilities, financed by private capital, will probably receive approval.

Ceramic Grade

Under the pressure of demand by the steel industry, a considerable tonnage of ceramic spar was used in the manufacture of basic electric steel during 1943; however, as the supply of metallurgical spar improves, it is anticipated that consumption by the steel industry will fall off and that ceramic production will again be consumed primarily by the glass and enamel industries. The production of this grade of spar is flexible, and, although stocks in the hands of the enamel and glass producers have been reduced, it is not anticipated that serious shortages will develop in 1944. It is somewhat more likely that the demand will diminish and will remain at a low level until the production of enamelware again approaches a peacetime level.

ARIZONA

» » » The Kay copper mine at Mineral Park has been completely unwatered for the first time in 20 years, and ore production now is under way. The ore shows 5 percent copper and some gold and silver, it is said. The mine is operated by the Mineral Park Copper Company, incorporators being J. L. Hylton and J. H. Hoffman.

» » » A bright post-war outlook for the copper industry is ahead if the Government keeps the copper it will have at the end of the war and does not dump it on the market, is the belief of Louis S. Cates, New York, president of Phelps Dodge Corporation.

In a press interview in Phoenix, Ariz., early in January, he said that post-war handling of copper stocks by the Government will determine the future of the copper industry. Mr. Cates said that his company's developments at Morenci, in Arizona, will give the state the world's largest copper ore milling plant when it becomes completed early in February. Capacity of the plant will be in excess of 50,000 tons of ore daily. The expansion project cost $26,000,000, he said. The development has been financed by the Defense Plant Corporation. One unit of the mill has been in operation for some weeks.

The new Morenci, Ariz., mill provides also for the processing of lower grade ores. The treatable supply of commercial ore, estimated at this time at 230,000,000 tons of 1 percent copper will be increased immeasurably, he said. Mr. Cates said that Arizona will benefit in the movement of industry to the Pacific Coast. The shift is permanent, he said. He also conferred with Governor Sidney P. Osborn, in Phoenix, on economic developments in the state.

» » » In Mohave County, at Yucca, sale of the lease on the Antler mine to R. B. Strassburger, publisher of the *Times-Herald*, Norristown, Pa., is reported. The Vukoye brothers opened a 33-ft. vein of copper-zinc ore in the mine in October while drifting from the bottom of an old 50-ft. shaft.

NEW MEXICO

» » » A new fluorspar mill at Gila, Grant County, 30 miles northwest of Silver City, started operation in January. The mill was built by the International Mineral and Chemical Company of Carlsbad for the Metals Reserve Company, under the supervision of E. C. Anderson. H. L.

Gardner is mill superintendent. The capacity of the mill is 300 tons daily, operating on three eight-hour shifts. A stockpile of 10,000 tons of ore has been sampled and is now being milled.

»»» Standing out as a conspicuous mining success in 1943 in New Mexico, is the Peerless mine in the Central Mining District of Grant County, operated by the New Mexico Ore Processing Company. D. W. Schmitt, vice president and general manager, in a report to stockholders, says that in ten months of operation, the mine, a zinc-lead property, has produced ore valued at around $250,000. Two dividends of 25 percent each have been paid to stockholders.

»»» Preliminary steps have already been taken for a post-war program for the mining industry of New Mexico by the officers of the New Mexico Miners and Prospectors Association. President Fred O. Davis, of Carlsbad and Secretary Albert P. Mracek of Silver City held a conference at Carlsbad to map plans and a meeting of the officers and directors will be called in the near future to take definite action. Expansion of mining to meet the demands of war has made it one of the major industries of New Mexico.

UTAH

»»» The United States Bureau of Mines is conducting a campaign of exploration at the Alta United properties at Alta, Utah. Ores carrying values in bismuth have been developed and the objective of the Bureau of Mines campaign is to test production possibilities of this strategic mineral at Alta United. Virtually all other Bureau prospecting work in this area has been halted.

»»» Following some trial runs, operations are now moving along more smoothly in the Salt Lake City tungsten plant being operated by the United States Vanadium Corporation for the Defense Plant Corporation. The 150-ton plant was completed late in 1943. Tungsten concentrates are shipped to the plant from Idaho, California and Nevada. D. D. Baker is superintendent.

CALIFORNIA

»»» Mines in California yielded (in terms of recoverable metals) 148,000 fine ounces of gold, 610,002 fine ounces of silver, 17,950,000 pounds of copper, 11,650,000 pounds of lead, and 3,750,000 pounds of zinc in 1943, according to preliminary figures compiled by the San Francisco office of the Bureau of Mines, United States Department of the Interior. These preliminary figures are based on 10 months' actual mine production, with November and December production calculated from reports by mine operators, refineries, and smelters of anticipated shipments and receipts.

California gold production in 1943 fell below that for any year since 1848, the year James W. Marshall made his historic discovery in the gravels of the American River near Coloma. Preliminary figures show California gold production in 1943 as 148,000 fine ounces valued at $5,180,000, compared with 847,997 ounces valued at $29,679,895 produced in 1942. The decrease in value—$24,499,895—is greater than any ever experienced before in California.

WASHINGTON

»»» At the recent annual meeting of the West Coast Mineral Association in Seattle, George H. Waterman of the Manufacturers Mineral Company was elected president and M. H. Van Nuys was elected vice president. Lulu Fairbanks was re-elected secretary-treasurer. The following were elected to the Board of Directors: Dean Milnor Roberts of the University of Washington School of Mines, Richard M. Brown, John Hovland, C. V. Brennan, Amos Slater, H. F. Yancey, W. J. Smith, Katherine Knowlton, and Marion Whitworth.

IDAHO

»»» The strike recently made in the Chester vein from the 2,700-ft. level of the Sunshine mine workings is admitted by district mining executives and engineers to be the most important and richest discovery of ore in the Coeur d'Alene district since the opening of the high grade ore bodies in the Sunshine mine. After receiving assays of 74 percent lead and 145 ounces in silver President L. E. Hanley, of the Hecla, which company is controlling owner of both Chester and Polaris, called it "leaser's dream ore." Drifting east on this vein a short distance developed an ore body 18 ft. wide which gave an average assay of 80 ounces of silver, besides high lead, copper and antimony values. All of the muck produced in drifting over 100 ft. on the vein was shipped direct to the Bunker Hill smelter without sorting or milling and gave net return of 25 percent lead and 50 ounces in silver per ton. The strike is proving beneficial to four different mining companies, Sunshine, Polaris, Silver Syndicate and Silver Dollar, all of whom have segments of the Chester vein system.

»»» Zanetti Brothers, owners of the Galena milling plant at Wallace, have leased the Atlas mining property at Mullan and have started production at 50 tons a day. The Hecla company recently held this property under bond and sunk a four-compartment shaft to a depth of 800 ft. and drifted over 1,000 ft. on the 800 level before surrendering the option. The present lease to Zanetti is from the tunnel level above the collar of the shaft. The ore is lead with no zinc and very low silver values.

»»» Production of garnets for commercial use is a new mining industry in Idaho. Two companies are now producing garnets in commercial tonnage in Benewah County, about 5 miles from Fernwood and close to the Shoshone County line, according to County Assessor W. H. Herrick, who visited the district recently in connection with the sale of delinquent tax property to one of the operating companies. Stanley & Craig is the name of one outfit operating a 50-ton mill on Emerald Creek, while another company is erecting a similar mill on an adjoining property. The garnets are alluvial deposits located in a big meadow where geologists say they have accumulated from ages of erosion of the rocks of the surrounding mountains. The deposits are covered by 5 or 6 ft. of surface dirt, under which the garnets are concentrated in a bed of varying thickness up to several feet. After removing the subsoil with a dragline shovel the garnet pay dirt is scooped up, goes through a grinding process, and then is treated much the same as lead and zinc ores.

»»» Hecla Mining Company officials confirm the purchase of the Boundary Basin Mines lead-zinc property in British Columbia, near the United States-Canadian border, 16 miles northwest of Metaline Falls, Wash. The purchase price is reported to have been $40,000 cash and 6 percent of possible future net smelter returns. The Boundary Basin Mines Company is 78 percent owned by the Red Bird Mining Company, the original prospect development outfit.

The ore exposed on Hecla's Boundary Basin group is estimated at 125,000 tons. This ore is oxidized, says L. E. Hanley, president and manager of Hecla, and the first move planned by the Hecla engineers will be to diamond drill the deposit to determine the depth of the oxidization and the value and extent of possible underlying sulphide ore bodies. This will be done before any provision is made for extensive mining operations, said Hanley.

Manufacturers Forum

New Hydraulic Puller a Time Saver

The Simplex Jenny Center Hole Hydraulic Puller, recently introduced by Templeton, Kenly & Co., was designed to accomplish in minutes production, maintenance and repair jobs which normally require hours.

This unit, it is said, has performed allegedly impossible tasks in general industry, construction, shipbuilding, mines, railroad shops and in the oil fields. It has also been used for pulling in utility service pipe. Applications include pulling bushings, cylinder liners, cutless bearings, pistons, wrist pins, valve seats, keys, wheels, sprockets, gears, boiler tubes and pipes. It is also used to pull structural members together for welding or riveting.

The Simplex Jenny pulls, pushes or lifts; and can also be readily rigged up as a portable press. This self-contained unit operates vertically or horizontally without the need for heavy auxiliary equipment, and with-

out side thrust or friction. The Jenny is its own back-up and is self-supporting because of its center hole construction.

Five models are available, of 30 to 100 tons capacity. The light weight of the complete unit in proportion to its capacity is a characteristic which is highly appreciated by operators. Three models have single pumps and two have high and low speed pumps which may be operated separately, alternately or together. Alloy steel rods are recommended as the Simplex Jenny will stretch, collapse or pull apart any mild steel rod that will fit through the center hole. The unit is built of heat-treated alloy steels to withstand heavy loads and service abuse. Each Jenny is tested before shipment for 50 percent overload.

Bulletin No. 43J will be mailed on request to the Templeton, Kenly & Co., Chicago, Ill.

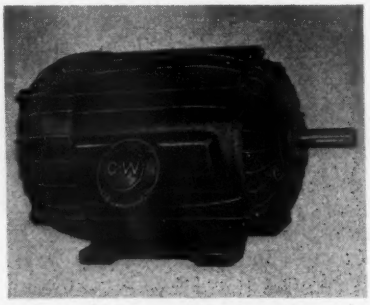
Ohio Brass Mansfield Division Awarded Army-Navy "E"

RECOGNIZING their ". . . . great accomplishment in the production of war equipment," the Army and Navy conferred their "E" Award upon the men and women in the Mansfield (Ohio) plant of The Ohio Brass Company, January 6, 1944. Brief but colorful ceremonies were held at which presentation addresses were made by Col. H. M. Reedall, Chief of the Cleveland Ordnance District, War Department, and Lieut. Comdr. A. E. Heiser, U. S. N. R., Resident Inspector of Naval Materials. Brig. Gen. Frank P. Lahm, U. S. Army, Retired, acted as chairman of the ceremonies.

"Sealed-Power" Motor Announced

The Crocker-Wheeler Division of the Joshua Hendy Iron Works announces the release of their SEALED-POWER, Corrosion-Resistant motor. This motor is said to be suitable for operation in atmospheres containing injurious dusts, corrosive vapors or gasses, and excessive moisture, such as are often encountered in chemical plants, textile mills, food plants and mines.

Available in sizes from 1 to 15 hp., the Sealedpower motor can be furnished for operation from any polyphase power supply. It is of the totally enclosed, fan cooled type, but the design departs from previous models in that there are no cooling ducts to become fouled with wet or sticky dusts. All exposed parts of the Corrosion Resistant model are acid and alkaline resistant to a high degree, it is claimed.



Full information will be furnished upon request to the Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.

R. H. Stearns Honored

R. H. Stearns, who is celebrating his twenty-fifth year as president of the Stearns Magnetic Mfg. Co., Milwaukee, was the guest of honor at a party for his office employes who presented him with a handsome silver scroll inscribed with the names of his fellow workers to commemorate the occasion. Among those present were his son, R. N. Stearns, sales manager; H. W. Harman, national sales representative; C. F. Broetzmann, chief engineer, and Hugh Sharp, advertising manager.

Twelfth and Thirteenth Production Awards Granted to Worthington Plants

Second and third star renewals of the Army-Navy "E" and Navy "E" production awards to two plants of Worthington Pump and Machinery Corporation have been announced by Admiral C. C. Bloch, U.S.N., chair-

man of the Navy Board for Production Awards. The two "E" awards constitute the 12th and 13th honors accorded the men and women and management of Worthington.

Wothington's Harrison, N. J., works won its fifth citation for "production excellence." Besides four consecutive Navy "E" pennants, the Harrison plant has been presented with the United States Maritime Commission's "M" Award Pennant and Victory Fleet Flag.

Worthington's Moore Steam Turbine Division at Wellsville, N. Y., has won a second renewal star, its third consecutive Army-Navy "E" Award.

Denver Equipment Moves to New Offices

To better serve their many customers and friends, Denver Equipment Company announced new quarters in Suite 414, Empire State Building, New York 1, N. Y. The new telephone number is CHickering 4-6510.

New Duff-Norton Catalog

A new complete catalog, streamlined for war work, has been issued by The Duff-Norton Manufacturing Company featuring the company's wide line of jacks for all jobs of lifting, lowering, pushing and pulling.

In addition to descriptions, specifications and illustrations of the various jacks in the Duff-Norton line, Catalog 202 contains many application photographs.

Copies may be secured by writing this publication or direct to the Duff-Norton Manufacturing Company, Pittsburgh, Pa.

Kensington Steel Receives White Star

Kensington Steel Company, Chicago, Ill., has been advised by Robert P. Patterson, Under Secretary of War, that they have been awarded the White Star for their Army-Navy "E" flag. Mr. Patterson's letter follows:

"To the Men and Women
of the Kensington Steel Company,
"505 East Kensington Avenue,
"Chicago, Ill.

"I am pleased to inform you that you have won for the second time the Army-Navy Production Award for meritorious services on the production front.

"You have continued to maintain the high standard that you set for yourselves and which won you distinction more than six months ago. You may well be proud of your achievement.

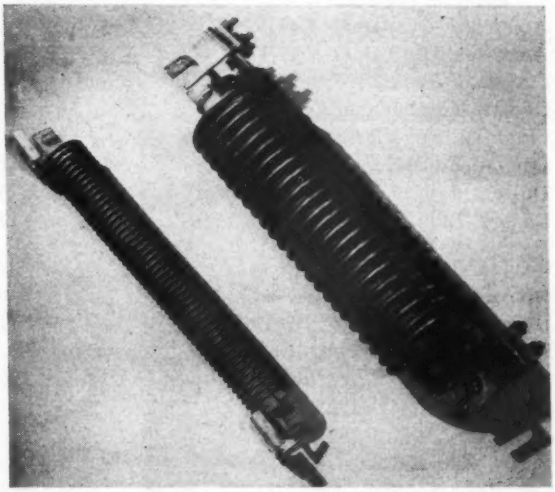
"The White Star, which the renewal adds to your Army-Navy Production Award flag, is the symbol of appreciation from our Armed Forces for your continued and determined effort and patriotism.

"Sincerely yours,

"Signed: ROBERT P. PATTERSON,
"Under Secretary of War."

New Type Resistor Element for 13 to 20-Ton Locomotives

A new type resistor element built by Westinghouse Electric and Manufacturing Company for use on open trolley mine and industrial locomotives, is said to have proved superior in service when applied to a number of locomotives ranging in size from 13 tons to 20 tons.



The illustration shows the comparative size of the new type element and the smaller type. Although the new element does not supersede the other one for small locomotives, it is definitely recommended for heavy duty haulage locomotives.

The fundamental design of this element is claimed to assure satisfactory operation because

1. More resistor capacity can be provided in a given space. This is advantageous on haulage locomotives where high current capacity is required of the resistor.
2. Each element is large and the the number per resistor and the number in multiple are reduced to a minimum. This eliminates numerous connections and terminals and insures more equal distribution of heating between elements.
3. The large elements have relatively high thermal capacity. They are constructed in such a manner that unusual electrical capacity is incorporated in the current carrying parts.
4. The element is mechanically strong. The construction is such that the frames which hold the insulators and resistor elements are several times as strong as those in other resistors of comparable capacity. The frame of the individual element consists of a triangular metal spider which, due to its truss-like structure, prevents warping.

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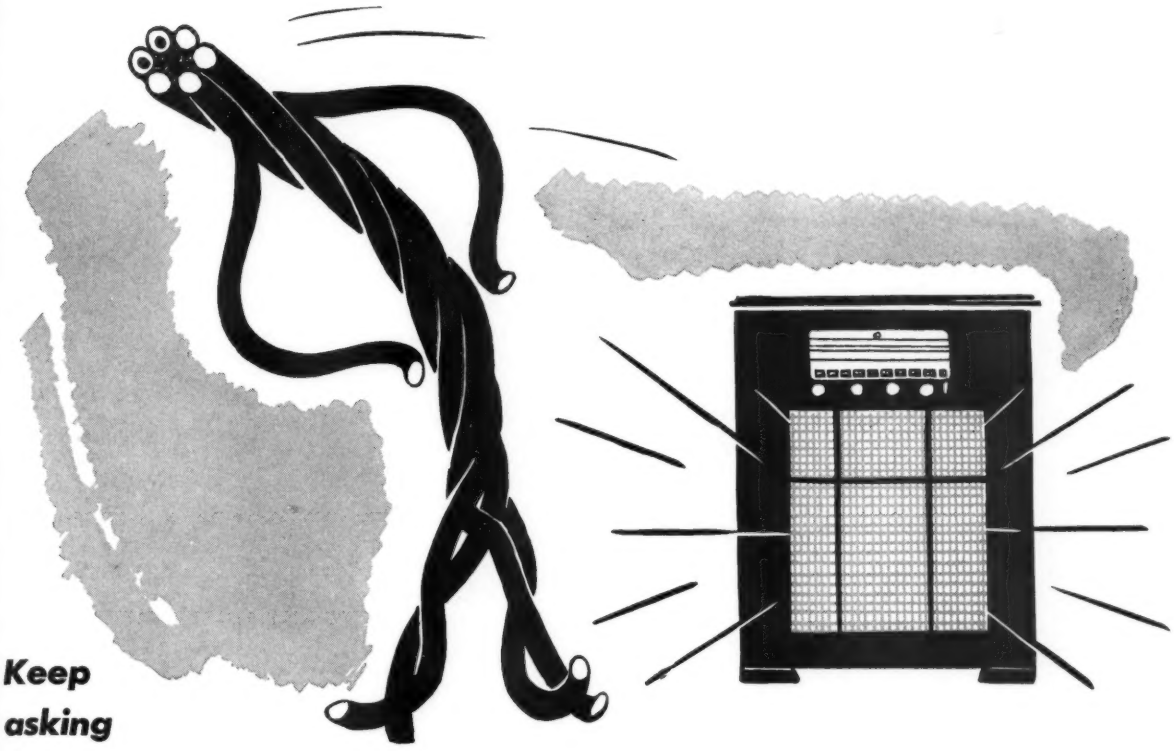

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● When a wire rope runs around a drum or sheave its wires flex and bend. This is grueling work for a non-preformed rope because of the internal stresses forcible twisting sets up in the wires. But the preforming process relieves TRU-LAY of such stresses and endows it with truly remarkable resistance to bending fatigue.

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